Industrial QUALITY CONTROL

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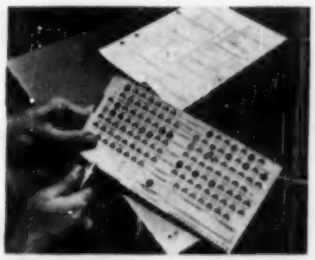
1



2

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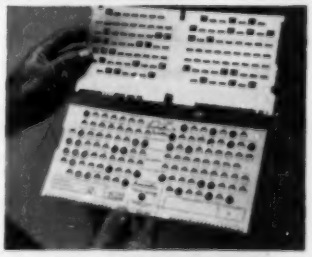
↓3

4



5

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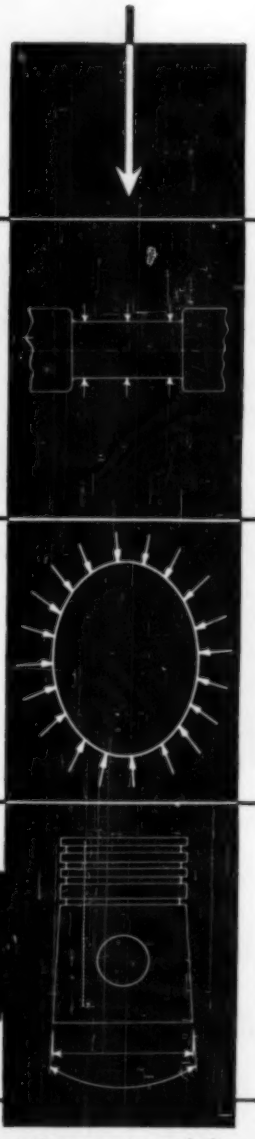

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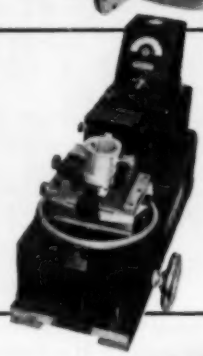

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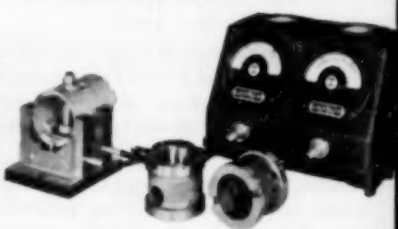

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Industrial Quality Control

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ERNIE FAY

It is with deep regret that we record the death on Saturday, January 29, 1955, of Ernest L. Fay, Founding Member and Fellow of the American Society for Quality Control, and Director of Quality Control for Deere and Company, Moline, Illinois. He had been associated with this company for 44 years.

Ernie's death resulted from complications that set in following an operation performed four days earlier. He is survived by his wife and twin sons, Melvern and Lavern, the former located with the Deere Organization at Des Moines, Iowa and the latter residing at Santa Maria, California. He had planned to retire within a few months and live on the West Coast.

Ernie was born in Independence, Iowa, November 8, 1888. He entered the employ of the Waterloo Gas Engine Company at Waterloo, Iowa, in 1910, which later became the Waterloo Tractor Plant of the John Deere organization. He was Chief Inspector at this plant when, in 1944, he attended an eight-day training course in SQC at the State University of Iowa. During this course he acquired an interest in this field which matured through succeeding years into a zeal that made him one of the most effective exponents that quality control through statistical methods has ever had.

In addition to his many services to the national Society, Ernie also showed a lively and continuing interest in local SQC activities. He was a member and former chairman of the State University of Iowa Section, ASQC. He was also General Chairman of the Eighth Midwest Quality Control Conference in 1953. He was in wide demand as a quality control speaker both within and outside of ASQC.

As a teacher, administrator and proponent of SQC, Ernie always had his feet on solid ground. He had a passion for insisting on adherence to fundamental principles, while at the same time possessing a superb faculty for blending basic theory with sound operating practice. His thirty years' experience as a chief inspector, coupled with his grasp of SQC as a powerful management tool, made him equally effective in presenting the modern philosophy of quality control both to the man in the plant and to top management.

Ernie was convinced that the best method for securing acceptance and support for SQC in a plant was to instill pride of workmanship in the worker by placing a chart at his machine and following through on the facts revealed by the chart. He maintained that the operator wanted to produce good workmanship—and would—if management gave him the tools and procedures available through SQC. His pioneering effort and loyal support of the Shewhart chart at the worker level was one of his outstanding contributions. Those who have had personal contact with Ernie's simple, straightforward, convincing approach to quality control problems will long remember his capacity for imparting a dynamic enthusiasm for SQC.

Charles Deere Wiman, President of Deere and Company, pays Ernie a fitting tribute, concurred in by all who knew him, when he says that Ernie was not just a teacher but an evangelist for quality control.

INTERNATIONAL QC CONFERENCE

Paul Clifford, currently serving as Consultant on SQC for the OEEC (Organization for European Economic Cooperation), writes that plans are underway for an international conference on quality control.

The conference is scheduled for July 8-13, but its location remains to be announced. July 8-9 will be used to receive reports by official delegates from the participating countries covering the status of quality control in these countries, and to formulate plans for future international cooperation.

July 11-13 will be devoted to the presentation and discussion of professional papers. Areas to be covered by these papers are: organization and administration of QC in a plant; the human relations aspect of QC; education and training in QC; economic and statistical aspects of specifications; problems in sampling; experimental design in industry; consumer-vendor relations; case histories on QC in particular fields; evaluation of complex assemblies; short runs and job lot problems.

Paul promises to send a copy of the final program details as soon as it becomes available.

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Membership in the Society is personal and professional, and is not open to corporations, companies, or other organizations.

Some Notes on the Theory and Application of Rank Order Statistics*

PART II

RALPH ALLAN BRADLEY

Virginia Agricultural Experiment Station, Virginia Polytechnic Institute

INTRODUCTION

In Part I of these notes, we discussed rank analogues of t tests for two independent samples, for two paired samples, and for a single sample. It was pointed out that there were both advantages and disadvantages in using ranking methods and that rank order methods of statistics required less restrictive assumptions about the nature of the populations sampled than do the more usual parametric methods of analyses. The case of two independent samples, where we used the Wilcoxon T test on ranks, was discussed in some detail with a view to illustrating the theory of rank order tests. It was seen that a significance level was obtained through a process of interchanging the ranks assigned to the two samples. This process of interchanging or permuting ranks is inherent in the theory of rank order statistics although the details were not discussed for the other tests considered.

When more than two samples occur in an experiment, it is customary in many situations to use analysis of variance. In this paper, we summarize and illustrate the use of rank analogues to the analysis of variance for C independent samples, for two-way classifications, or the randomized block design, and for balanced incomplete block designs. In all of these cases, the valid application of analysis of variance depends on the assumptions that observations come from normal populations that have equal variances and that these observations are independent. The rank order methods leave the form of the populations unspecified.

Some additional notes on the use of scores for ranked data are included. These notes are based partly on the work of Terry,[12] who considered only a two-sample problem, but the conclusions may apply more generally.

THE H TEST FOR C INDEPENDENT SAMPLES

We are here interested in a generalization of the two-sample problem discussed in reference to the method of Wilcoxon. C independent samples may be considered with the samples given by $X_{11}, \ldots, X_{1n_1}; \ldots; X_{C1}, \ldots; X_{Cn_C}$. These observations are replaced by ranks with the ranking effected over the totality of $N = n_1 + \ldots + n_C$ observations, or, in some cases, the ranks may have been recorded directly. Data of this kind belong to Type A, as defined in Part I,[3] and an illustrative set of data is shown in Table I of this paper. It is desired to test for the equality of the means (or location parameters) of the C populations sampled. Kruskal and Wallis[10] have developed a rank order method based on a statistic, H, for this situation, and we illustrate its use, noting only that the theories again involve the possible interchanges of ranks as shown for the Wilcoxon test.

TABLE I—Water Content After Storage

Method of storing	Water Content in percent	Ranks assigned	R_i
1	7.8 8.3 7.6 8.4 8.3	8 4.5 9 3 4.5	29
2	5.4 7.4 7.1	14 10 11.5	35.5
3	8.1 6.4	6 13	19
4	7.9 9.5 10.0	7 2 1	10
5	7.1	11.5	11.5

The H statistic is defined,

$$H = \frac{\dfrac{12}{N(N+1)} \sum_{i=1}^{C} \dfrac{R_i^2}{n_i} - 3(N+1)}{1 - \Sigma T/(N^3 - N)} \qquad (1)$$

where

R_i = the sum of ranks in the i^{th} sample,
n_i = the number of observations in the i^{th} sample,
$N = \sum_{i=1}^{C} n_i$,
C = the number of samples,
$T = t(t-1)(t+1)$,
t = the number of tied observations in the group,
ΣT denotes a summation over the groups of tied observations.

H, for large samples, has the chi-square distribution with $(C - 1)$ degrees of freedom. Tables for small samples have been given only for $C = 3$ with $n_i \leq 5$. Comparisons of tabulated probabilities and those obtained with the use of the chi-square approximation indicate that the latter will be adequate in most practical situations. The denominator of H has been adjusted from unity to allow for the possibility of ties. H is equivalent to the conventional F statistic with ranks for the purpose of developing a rank order test.

The H test is illustrated using the example of Hald[8] given in Table I. Water contents in percents following five methods of storing are recorded for 14 samples of a given product. Observations are replaced by ranks in the second section of the table (note that two sets of tied ranks occur) and the final column contains values of R_i. In the example we have

*Prepared under a Research and Marketing Act Contract, Project RM: c-629-1, with the Bureau of Agricultural Economics. This publication is the second part of a paper presented to the American Society for Quality Control at the Middle Atlantic Regional Conference, Baltimore, Md., Feb. 5, 1954. Part I appeared in the February, 1955 issue of IQC.

$n_1 = 5$ $\quad C = 5$ $\quad \Sigma T/(N^3 - N) = 0.0044$

$n_2 = 3$ $\quad N = 14$

$n_3 = 2$ $\quad t = 2, 2$ $\quad \sum_{i=1}^{c} \frac{R_i^2}{n_i} = 934.36$

$n_4 = 3$ $\quad T = 6, 6$

$n_5 = 1$

Substitution in (1) yields

$$H = \frac{\frac{12}{(14)(15)}(934.36) - 3(15)}{1 - .0044} = 8.43$$

and comparison with the distribution of chi-square with four degrees of freedom fixes the approximate significance level at 0.08. Hald obtains the level 0.06 using standard analysis of variance. The two results are in good agreement since there is an indication that the chi-square approximation is usually conservative.

METHOD OF CONCORDANCE FOR A TWO-WAY CLASSIFICATION

For a two-way classification, observations on treatments or items are ranked within the second classification. That is, if a single observation on each of n items is included in each of m classes, we consider m rankings of n items. To illustrate, in terms of the example of Table II below, we have n = 4 samples, A, B, C, and D, grouped into m = 4 experiments. This type of experimental design is commonly referred to as a randomized block design and the four experiments correspond to four blocks. Data obtained in this way are said to be of type B, as previously defined, and the experimental design is a generalization of the two paired samples for which the sign test is the appropriate rank order method.

TABLE II—Net Counting Rates less 25.00

SAMPLE	Experiment Number								SAMPLE SUM OF RANKS
	1		2		3		4		
A	1.46	(4)	2.60	(4)	1.48	(4)	1.51	(4)	16
B	2.58	(3)	3.03	(3)	2.82	(3)	2.90	(3)	12
C	4.15	(2)	4.56	(1.5)	4.31	(2)	4.14	(1.5)	7
D	4.54	(1)	4.56	(1.5)	4.53	(1)	4.14	(1.5)	5

For a test of the null hypothesis of absence of differences between the samples, A to D, the observations are ranked within the second (experiment number) classification. Then, in the example, a ranking of the observations on samples is made within each experiment. The method of concordance was developed by Kendall and Babington Smith[9] for ranking in this way. We shall illustrate the method after first defining the coefficient of concordance.

The coefficient of concordance with adjustments for tied ranks is

$$W = \frac{S}{\frac{1}{12} m^2(n^3 - n) - m \sum_{T'} T'} \qquad (2)$$

where S = the sum of squares of deviations of treatment rank sums from their mean, $\frac{m(n+1)}{2}$,

m = the number of classes,

n = the number of treatments,

$T' = \frac{1}{12} \sum_{t} (t^3 - t)$,

t = the number of tied ranks in a group of ties,

$\sum_{t}$ in T' is a sum over the groups of ties in a ranking, and

$\sum_{T'}$ is a sum of values of T' for all m rankings.

We have retained Kendall's notation to avoid confusion. The denominator of W reduces to $\frac{1}{12} m^2 (n^3 - n)$ when no ties are present.

For small sample sizes it is sufficient to compute S and to use limited tables that are available. Kendall and Babington Smith have prepared tables of the distribution of S for n = 3, m = 2, . . . , 10; n = 4, m = 2, . . . , 6; and for n = 5, m = 3. When larger sample sizes are used, m(n − 1)W has approximately a chi-square distribution with (n − 1) degrees of freedom.

The data of Table II are a record of counts made with a Geiger counter on four samples of radium. The experiment numbers indicate replications in time. These data were given by Youden[15] and we shall use them to illustrate the concordance method. Minor liberties have been taken with the data to introduce two ties so that the handling of ties may be demonstrated. Ranks are inserted in parentheses within the table.

Tables may be used for the example of Table II and for this purpose it is only necessary to compute

$$S = (16 - 10)^2 + (12 - 10)^2 + (7 - 10)^2 + (5 - 10)^2 = 74.$$

The tables are not exact when ties occur but they yield significance levels that are approximately correct. We enter the table with n = 4 and m = 4 and find that the value S = 74 does occur and with a significance level 0.00094 indicating sample differences.*

For an approximate analysis we require

$S = 74$ $\quad t = 2, 2$

$m = 4$ $\quad T' = 0.5, 0.5$

$n = 4$ $\quad \sum_{T'} T' = 1$

$$W = \frac{74}{\frac{1}{12}(16)(60) - 4(1)} = 0.974$$

$$m(n-1)W = 4(3)(0.974) = 11.69$$

Tables of chi-square with three degrees of freedom show that 11.69 falls between the 0.01 and the 0.001 levels of significance.

CONCORDANCE FOR BALANCED INCOMPLETE BLOCK DESIGNS

In many types of experiments it is not possible to obtain observations on all of the required treatments or items under uniform conditions. The use of incomplete block designs alleviates this difficulty through statistical analyses that remove the effects of differences among blocks from the experimental error. An incomplete block may be regarded generally as a set of observations on a subset of treatments obtained under conditions that are satisfactorily uniform. Balanced incomplete block designs have the property that any two treatments appear together equally often in incomplete blocks.

*Analysis of variance on the original observations yields F = 320 with three and nine degrees of freedom. This value of F exceeds the 0.001 level of significance.

Durbin[5] has generalized the method of concordance to balanced incomplete block designs for tests of the hypothesis of equality of treatment effects.

Data obtained in incomplete block designs are of type B since the grouping of treatments into blocks represents a second method of classification. Observations within the incomplete blocks are replaced by ranks, a separate ranking being effected over the observations on the subset of treatments in each incomplete block. However, again, in some experiments, ranks within the blocks may have been recorded directly and this was the case in the example that we shall consider.

The data that we shall use to illustrate Durbin's method were obtained at the Virginia Agricultural Experiment Station from an experiment on preferences for nine brands of canned tomatoes. The basic design used is a balanced lattice design with nine treatments or brands with incomplete blocks of size three. Each treatment is included in four blocks and each pair of treatments is included in only one block. The whole design was repeated three times, once for each of three tasters. No numerical observations were obtained; the tasters simply ranked the items directly in each incomplete block on the basis of their preferences. The design lay-out is given by Goulden[7, p. 274] and we repeat it here with some changes in notation and arrangement for the convenience of the reader. The letters A, B, . . . , J, excluding I, were assigned to the nine brands. The basic lattice design has four replications, each with three blocks of size three, and they are as follows:

Block	Rep. I		Rep. II		Rep. III		Rep. IV
(1)	A,B,C	(4)	A,D,G	(7)	A,F,H	(10)	A,E,J
(2)	D,E,F	(5)	B,E,H	(8)	B,D,J	(11)	B,F,G
(3)	G,H,J	(6)	C,F,J	(9)	C,E,G	(12)	C,D,H

The list of rankings obtained by the three judges following this design is given in Table III.

The balanced lattice design of our example is one of a class of balanced incomplete block designs which have the additional feature that the number of treatments is the square of the block size. Our basic design is also given by Cochran and Cox [4, plan 10.1, p. 304] in slightly different form and many other balanced incomplete block designs are given in this reference (see Chapters 10 and 11).

Durbin's notation is similar to that of the preceding section except that certain additional design parameters are needed. The coefficient of concordance is now

$$W = \frac{12S}{\lambda^2 n(n^2-1)}, \qquad (3)$$

where S = the sum of squares of deviations of treatment rank sums from their mean, $\frac{1}{2}m(k+1)$,

n = the number of treatments,

k = the number of treatments in an incomplete block,

$\lambda = \frac{m(k-1)}{n-1}$, the number of blocks in which a particular pair of treatments occurs,

m = the number of times a treatment is ranked in the experiment.

No adjustment has been made in (3) for the possible presence of ties and Durbin notes that the necessary adjustment would be quite complicated for these designs. It is not thought that ties will seriously affect the

TABLE III—Ranks on the Flavors of Nine Brands of Canned Tomatoes

TASTERS	*Replication I*								
	Block 1			Block 2			Block 3		
	A	B	C	D	E	F	G	H	J
I	1	2	3	2.5	2.5	1	2.5	1	2.5
II	2	1	3	3	2	1	1.5	3	1.5
III	3	2	1	3	1	2	3	2	1
	Replication II								
	Block 4			Block 5			Block 6		
	A	D	G	B	E	H	C	F	J
I	1	2	3	1	2.5	2.5	3	1	2
II	1	2	3	2	1	3	2	2	2
III	1	2	3	1	2	3	2.5	1	2.5
	Replication III								
	Block 7			Block 8			Block 9		
	A	F	H	B	D	J	C	E	G
I	2	1	3	2	3	1	2.5	1	2.5
II	3	2	1	2	3	1	1.5	1.5	3
III	1	2	3	1	2	3	1.5	1.5	3
	Replication IV								
	Block 10			Block 11			Block 12		
	A	E	J	B	F	G	C	D	H
I	1	2	3	2.5	1	2.5	3	2	1
II	1.5	3	1.5	2	1	3	3	1.5	1.5
III	2	1	3	1	2	3	1	2	3

analysis unless they are quite numerous and it has been suggested that a valid way of eliminating ties is to assign the ranks at random to the tied observations. There are no tables available for this method but Durbin has shown that

$$\frac{\lambda(n^2-1)}{k+1}\,W$$

has, for large values of m, an approximate chi-square distribution with $(n-1)$ degrees of freedom.

The data of Table III show the ranks assigned to samples of nine brands of canned tomatoes by three tasters who ranked the samples in order of preference of flavor. The nine brands are designated by the letters

TABLE IV—Rank Totals for the Nine Brands

Brand	A	B	C	D	E	F	G	H	J
Rank Total	19.5	19.5	27.0	26.0	21.0	17.0	33.0	27.0	24.0

A to J excluding I, as noted above, and the three judges by the numerals I, II, and III. Treatment rank totals are given in Table IV. For the data,

$$S = 213.5 \qquad \lambda = 3$$

$$n = 9 \qquad m = 12$$

$$k = 3 \qquad W = \frac{12(213.5)}{9(9)\,(81-1)} = .0395$$

$$\frac{\lambda(n^2-1)W}{k+1} = \frac{3(81-1)\,(0.395)}{4} = 23.7$$

With eight degrees of freedom, the value 23.7 falls between the significance levels 0.01 and 0.001. The conclusion is, of course, that differences in flavor do exist among the brands of canned tomatoes.

SCORES FOR RANKED DATA

Fisher and Yates and many other authors have recommended replacing ranked data by scores. These scores have been tabulated in Table XX of reference (6) and are in effect the expected values of the ranked observations on the assumption that the samples come from a standard normal population. The efficacy of this procedure has not been thoroughly investigated. It has been suggested however that the use of scores instead of ranks may make the distribution theory easier and permit the use of approximations to distributions with greater accuracy for smaller sample sizes. There is also the possibility that the use of scores may lead to rank order tests with improved powers. The method is convenient since it is common practise to use standard analysis of variance on the scores and this can be done for even complex designs.

Terry[12] has developed a two-sample rank order test that is comparable to those of Wilcoxon and Mann and Whitney. Terry's test depends on the statistic,

$$c_1\,(R) = \sum_{j=1}^{N_2} E(Z_{N r_{N_1+j}}) \qquad (4)$$

and this simply means that c_1 (R) is equal to the sum of the scores assigned to the second sample of size N_2. Again, we use $N = N_1 + N_2$. It is a property of the scoring system that $\sum_{i=1}^{N} E(Z_{Ni}) = 0$ so that c_1 (R) may be obtained by summing over either sample and using the numerical value of the sum for c_1 (R).

Terry has demonstrated that

$$u'' = \frac{c_1\,(R)}{\sqrt{\dfrac{N_1N_2}{N(N-1)}\sum_{i=1}^{N} E(Z_{Ni})^2}} \qquad (5)$$

has a standard normal distribution for large samples. In this expression $\sum_{i=1}^{N} E(Z_{Ni})^2$ is a constant for fixed values of N and may be read directly from Table XXI of the reference [6]. Tables for percentage points of the distribution of c_1 (R) have been provided for $N = 2, \ldots, 10$ for possible values of N_1 and N_2 for one-sided tests.

The c_1 (R) test has certain known characteristics. It belongs to the class of most powerful rank order tests defined by Hoeffding, and Terry shows that his test is the most powerful rank order test of whether N observations come from the same but unknown population against the alternative that the populations sampled are normal with unequal means but equal variances. By sampling methods it is shown that the power curve for c_1 (R) is quite close to that of the t statistic for both small and large departures from the null hypothesis but that it falls below that of t for intermediate values. The correlation between the c_1 (R) test and the Mann and Whitney test is shown to exceed 0.99 when $N \leq 15$.

TABLE V—Compressive Strengths of Test Cubes of Concrete

CONCRETE	Ranks under Conditions A									
I	7	16	2	15	13	6	10	1	8	4
II	14	19	18	11	17	9	20	3	12	5
	Scores for Ranked Data									
I	.45	−.75	1.41	−.59	−.31	.59	.06	1.87	.31	.92
II	−.45	−1.41	−1.13	−.06	−.92	.19	−1.87	1.13	−.19	.75

In Table V we have recopied the ranks from Table II, Part I,[3] in the first section and in the second section we have recorded the corresponding scores obtained from Table XX of reference (6). The sum of the scores for the first sample is c_1 (R) = 3.96. We shall need the approximate test.[5] From Table XXI,

$$\sum_{i=1}^{N} E(Z_{Ni})^2 = 17.7144$$

and then

$$u'' = \frac{3.96}{\sqrt{\dfrac{10(10)}{20(19)}\,(17.7144)}} = 1.83$$

Assuming u'' to be a standard normal variate, the significance level is 0.067 for a two-sided test. The comparable figure for the Wilcoxon test is 0.089.

Comparison of significance levels based on Terry's test and Wilcoxon's test may indicate that the former is slightly more sensitive. However, the important feature of Terry's work is that it provides some indication that the use of scores to replace ranks before analysis of variance may be a very appropriate way of handling the analysis of ranked data. This method does require more calculation than the Wilcoxon test in the two-sample case and any gains in efficiency may be offset by the additional work required.

DISCUSSION

These papers were prepared with a view to giving some insight into the theory of rank tests and examples of their use. The lengthy treatment of the Wilcoxon

method in Part I was designed to show how significance levels of test statistics depend on possible rearrangements of the ranks. This is typical of the theory of rank order tests. Similar procedures are necessary to compute small-sample tables for the H test or the concordance method. Theories involved with the properties of tests have been omitted since they are not directly required for an understanding of the methods. There are many other rank order tests of interest but the ones selected appear to be of most general utility. The method of rank correlation could have been included but this has been illustrated recently by Wallis.[14]

When first considering the subject matter for this paper, we intended to include some notes on the method of paired comparisons. We first became interested in this subject at the Virginia Agricultural Experiment Station when it appeared to be a very useful method for tests involving subjective judgments. Considerable research has been done on the subject and we refer the reader to references[1, 13, 2]. A simplified description of the application of the method is given in the second reference while tables appear in the first. Further tables have been computed and published.[3a]

Savage[11] has recently prepared a very comprehensive bibliography of rank order statistics to which the reader is referred for additional methods.

References

1. Bradley, R. A. and Terry, M. E. The Rank Analysis of Incomplete Block Designs. I The Method of Paired Comparisons. *Biometrika* 39, 324-345, 1952.
2. Bradley, R. A. Incomplete Block Rank Analysis: On the Appropriateness of the Model for a Method of Paired Comparisons. *Biometrics* 10 (3), 375-390, 1954.
3. Bradley, R. A. Some Notes on the Theory and Application of Rank Order Statistics, Part I. *Industrial Quality Control*, Vol. XI, No. 5, February 1955, 12-16.

3a. Bradley, R. A. The Rank Analysis of Incomplete Block Designs. II Additional Tables for the Method of Paired Comparisons. *Biometrika* 41, 502-537, 1954.

4. Cochran, W. G. and Cox, Gertrude M. *Experimental Designs.* John Wiley and Sons, Inc., New York 1950.
5. Durbin, J. Incomplete Blocks in Ranking Experiments. *Br. Jour. of Psychology*, Stat. Section, 4, 85-90, 1951.
6. Fisher, R. A. and Yates, F. *Statistical Tables.* 4th Edition, Hafner Publishing Co., New York, 1953.
7. Goulden, C. H. *Methods of Statistical Analysis.* 2nd Edition, John Wiley and Sons, Inc., New York, 1952.
8. Hald, A. *Statistical Theory with Engineering Applications.* John Wiley and Sons, New York, 432, 1952.
9. Kendall, M. G. and Babington Smith, B. The Problem of m Rankings. *Annals of Math. Stat.* 10, 275-287, 1939.
10. Kruskal, W. H. and Wallis, W. A. Use of Ranks in One-Criterion Variance Analysis. *J. of Amer. Stat. Assoc.* 47, 583-621, 1952.
11. Savage, I. R. Bibliography of Non Parametric Statistics and Related Topics. *J. of Amer. Stat Assoc.* 48, 844-906, 1953.
12. Terry, M. E. Some Rank Order Tests which are Most Powerful Against Specific Parametric Alternatives. *Annals of Math. Stat.* 23, 346-366, 1952.
13. Terry, M. E., Bradley, R. A. and Davis, L. L. New Designs and Techniques for Organoleptic Testing. *Food Tech.* 6(7), 250-254, 1952.
14. Wallis, W. A. Rough-and-Ready Statistical Tests. *Industrial Quality Control* 8(5), 35-40, 1952.
15. Youden, W. J. The Interpretation of Chemical Data. *Industrial Quality Control* 8(6), 90-93, 1952.

Army Ordnance Gaging Problems and Practises

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INTRODUCTION

In the United States the use of gaging in interchangeable manufacture dates back to the year of 1798 when Eli Whitney, the inventor of the cotton gin, received a contract to manufacture muskets. He realized that if he followed the European methods of custom fitting each part he could not meet his contract. Using his truly American ingenuity he set out to manufacture muskets on what was a production basis at that time using specialized machinery and a gaging system to produce interchangeable parts. The Whitney musket as designed and produced could be assembled without the usual painstaking hand-fitting, and the parts of several muskets could be interchanged. Whitney achieved this interchangeability by strict adherence to self-established gage and measurement standards. It was not until some time later that definite gaging and measuring standards were established on a national basis.

Today in the production of ordnance materiel, large, medium, and small manufacturing enterprises have government contracts. The manufacturing and inspection methods are such that the various component parts which comprise a complete item of materiel can be manufactured by sub-contractors throughout the country and when furnished to the prime contractor for assembly, will fit into the assembly and function as intended. The Ordnance Corps is responsible for the production of the required materiel for the various using services within the Department of the Army.

ORDNANCE CORPS ORGANIZATION

The Ordnance Corps is organized on a mission center basis, that is, a certain installation is completely responsible for the development, product engineering and procurement of a particular type of ordnance materiel. For instance, Detroit Arsenal handles all matters pertaining to tank and automotive materiel, Watervliet Arsenal handles all cannon, Springfield Armory handles small arms weapons, and Frankford Arsenal is a sort of hybrid in that the mission responsibility here includes small arms ammunition, fire control instruments, VT and MT fuzes, cer-

tain cartridge cases and shell as well as responsibility for coordinating the Ordnance Gage Program on a national basis. The term "fire control instruments" refers to precision optical and electronic equipment required in directing the fire of both mobile and stationary type weapons as opposed to equipment used for extinguishing fires.

The Ordnance Corps also operates a network of 14 district offices in the larger cities which handle the administration of contracts in their area and the acceptance inspection of materiel produced on those contracts.

The gage program is organized on a similar basis. Each of the manufacturing arsenals or mission centers maintains a gage organization responsible for the design and supply of gages and inspection equipment for their assigned type of materiel. Each arsenal maintains a gage laboratory for performing the dimensional inspection necessary for the acceptance of gages procured for their program. The gages are then issued by the mission arsenals to the district having responsibility for acceptance inspection. The district, in turn, issues the gages to its resident inspector at the plant producing the item.

Each of the district offices maintains its own gage laboratory and a small staff of gage engineers or technicians. The gage engineers are concerned primarily with assisting their resident inspectors and the contractors with their gaging problems. Where possible the districts discuss the gage problem and the scope of inspection, as outlined on the Standard Inspection Procedure, with the contractor at the time the contract is placed. The district offices, as a regular procedure, provide the contractor with a set of prints of ordnance gage drawings and gage lists, if they are available. The primary purpose for supplying these drawings is of course to provide the contractor with information as to what dimensional characteristics will be inspected so that he may set up his quality control program for process inspection along the same lines. Where a new item is involved and gage drawings are obviously not available, the district and mission arsenal gage engineers stand ready to assist in any way possible.

Many contractors, of course, through their experience in gaging during World War II and through the quality control and gage programs they have established for their own product, do not require this type of assistance. However, it has been our experience that the high percentage of contractors that get into the ordnance production program do not have, or have not had a previous occasion to have, an organized gaging system. We have found that the district offices can be of considerable service to these contractors.

The district gage laboratories are established primarily for the purpose of maintaining surveillance inspection over final inspection gages in use in the various contractor's plants within the district. This function is one of the most important cogs in the ordnance production machine. We learned this through several rather unfortunate experiences at the outset of World War II; however, since we had the nucleus of a district gage laboratory set-up established at that time, we were able to remedy the situation quickly. Each of these laboratories is currently mantaining between 10,000 and 20,000 gages under surveillance. When ordnance final inspection gages are not available, contractual arrangements usually provide that the contractor shall make his process gages available to the government inspector in order to accomplish acceptance inspection. When the contractor's gages are used for final acceptance, it is necessary that the district gage laboratory certify the dimensional correctness of the gages and this is usually accomplished by direct measurement in the district gage laboratory. The gage laboratories are also responsible for maintaining the gages in the hands of the resident inspector up-to-date with the latest part drawings as authorized by the contract. The modification of gages which require correction is usually handled by the district through a contract with a local tool and gage shop.

A secondary purpose of the district gage laboratory is to assist the eight mission arsenals in handling the acceptance inspection load of new gages procured by the government. This arrangement has many benefits in that the district gage laboratory can maintain close personal contact with the tool and gage shops and rejections can be discussed on a first hand basis.

TWO CLASSES OF GAGES

Thus far, reference has been to gages as a general category. However, to fully appreciate the entire program it appears desirable to discuss gages in their specific classifications: namely, inspection gages and manufacturing gages. Inspection gages are those that are used by resident inspectors of ordnance assigned to a contractor's plant for the acceptance of materiel. They are also used for final inspection in our government arsenals. These gages are generally designed and supplied by the Ordnance Corps. The second classification covers manufacturing or process gages and are those gages used by the contractor or the manufacturing division of an arsenal for process or screening inspection before presenting material to the ordnance inspector. These gages are designed and procured by the user. As a matter of general policy, ordnance final inspection gages are designed to provide for the inspection of the finished part to the part drawing in such a way that the contractor may have complete latitude in selection of his method of manufacture and dimensional control.

ORDNANCE INSPECTION SCOPE AND PRACTICE

Ordnance inspection is generally conducted on a sampling basis in accordance with recognized quality control procedures. The inspection plan or the scope of gaging is laid down in what we term a Standard Inspection Procedure or SIP. The gage lists issued by our arsenal gage organizations are coordinated with the SIP's and, in fact, usually precede the SIP and serve as the scope of gaging until the formal SIP can be issued.

The scope of gaging or inspection required varies considerably with the type and end use of the item. Ordnance constantly strives to accomplish acceptance of materiel with the *minimum* scope of inspection that will insure that materiel will be safe for handling and will stand up under battle conditions. Correllary factors, of course, are the inspection cost as well as the conservation of manpower.

In line with this approach, wherever the type or function of materiel will allow, acceptance is accomplished based on a performance test or on an end-item inspection basis. For instance, end-item inspection is accomplished on certain fuzes and the only dimensional inspection by gaging is on the thread which serves to assemble the fuze to the projectile.

In the case of a complex item such as a tank which contains numerous complete unit type subassemblies, the scope of dimensional inspection for final acceptance is confined as much as possible to the inspection of those dimensions which affect interchangeability to insure that replace-

ment can be accomplished in the field without need for further machining. Interchangeability gages which are designed to simulate the mating part or assembly are provided. Since certain problems of alignment, centrality, location, etc. in assembly are extremely difficult to cover by a dimensional specification, interchangeability gages are usually designed to insure interchangeable assembly rather than to check parts for strict compliance with dimension specifications.

In those cases where individual parts of an assembly or sub-assembly are considered as replacement parts in the field, it is necessary to design and supply gages for the critical dimensions on these parts and to insure that the original as well as the spare part production meets these gages.

The cost of acceptance inspection as well as the cost of gages is, of course, of concern to all of us. As previously stated, the Standard Inspection Procedure outlines a *minimum* scope of inspection and classifies the dimensional features to be inspected as critical, major, minor and incidental. Critical defects are usually inspected 100 percent and consequently, automatic and semi-automatic gages are considered for these applications. The high initial cost of the gages is easily amortized by the subsequent saving in inspection time. Gages designed to inspect minor and incidental defects are usually of a simple type which will satisfactorily gage the component dimension.

The final acceptance inspection of ordnance materiel as conducted by the resident inspector is generally conducted on a sampling basis in accordance with recognized quality control procedures. Military Standard 105A "Sampling Procedures and Tables for Inspection by Attributes" is the guide used in the Department of Defense. Ordnance Inspection Handbook ORD-M608-9 on "Statistical Quality Control and Acceptance Sampling" is a guide used in quality control programs throughout the Ordnance Corps.

RECENT DEVELOPMENTS IN GAGE DESIGN

It may be useful to review in a very general way some of the recent developments in the field of gage design. Several significant advances have been made in the application of optical gaging methods in the inspection of ordnance materiel. Alignment of various critical surfaces on tank hulls are now being checked optically. The purpose of the hull alignment gage is to achieve a rapid, efficient and economical check of the machining and welding of the hull suspension mounting surface. As the speed, steering qualities, wear and general performance of the vehicle is largely governed by the proper alignment of its suspension system this check can be considered critical. Optical alignment gages have enabled the inspector to check the relationship of all significant points in one simple operation. They further provide for the systematic charting of the dimensional accuracy of each hull for controlling and correcting machining. The manufacturer can be furnished specific information as to location and degree of inaccuracies for effecting corrective measures. It has been established that due to the peculiarities in each hull type and the method by which they are held for machining, certain adjustments from true alignment are required in the machine tools to produce correct results after removal from the machine. The complete inspection procedure is too lengthy to outline here; however, the device is essentially a series of telescopes and targets.

The determination of surface roughness on a production basis has long been a problem in ammunition production since the degree of surface roughness affects the flight characteristics of projectiles. The initial development of a pneumatic type comparator gage was conducted by ordnance. A contract was placed with a private facility for the further development and perfection of the method and as a result a unit has been developed which is now in wide usage in ammunition inspection. The unit consists of a measuring head which has a flexible washer-type contact point mounted on a rubber backing to insure that the contact will conform to the general contour of the product and thus measure only the effect of surface roughness. A fixture has been developed and is now in use which provides for reading of surface roughness at three points simultaneously on the surface of a 75mm recoilless shell. This gage has proven to be fast, accurate and will repeat. A major problem exists in connection with establishing a definite correlation between the readings obtained on an air comparator type gage and those obtained on a direct-reading tracer type unit. There is still considerable work to be done in this field and our engineers are now cooperating in several ASA projects on this subject. In summation, we feel that the air comparator type gage is a significant step forward in the production inspection of surface roughness.

The gaging of complex parts having a considerable number of critical dimensions has always presented a problem, especially when the location of a feature is dependent upon several dimensions and tolerances. Fixed gages must necessarily consider maximum metal conditions and thus the gage for such a feature may give results considerably in error if the part is made to minimum metal dimensions on the correllary dimensions. A great number of these problems have been solved by the application of optical projection methods in all of our ordnance arsenals. Several unique applications have been developed recently on the complex components of the mechanical time fuze. Savings in inspection manpower will be considerable but the major advantage will be in the improved control of the product and consistent inspection results.

Another development which has created considerable interest is the Mobile Gage Laboratory which was designed by the Gage Engineering Division of Detroit Arsenal. The purpose of this unit is to provide a mobile, temperature-controlled, gage inspection laboratory that can be shuttled between various contractor's plants in an ordnance district area to provide for "on the spot" surveillance inspection and thus eliminate the time consumed in returning gages to a central laboratory for surveillance which may also mean tieing up production. The use of this unit can also, to some extent, reduce the need for procurement of "back up" sets of gages which are normally needed to insure continuity of inspection operations while surveillance inspection is being conducted at a central laboratory.

GAGE STANDARDIZATION

There has also been progress in the field of gage standardization. This is of particular interest in view of the economies that will be effected by this program over the ensuing years. The most common types of gages used for the final dimensional inspection of ordnance material are plain plug, plain ring, thread plug, thread ring, and adjustable snap gages. Up to and including World War II, it was the policy of the Ordnance Corps to prepare an individual drawing to represent these type gages when required for the inspection of a particular dimension. Since there were seven designing arsenals, duplications in design occurred due to the recurrence of identical dimen-

sions on different items of materiel. Procurement was accomplished by sending a print to each potential bidder which also was costly. During the past several years Military Standard catalogs have been prepared which provide complete specifications for widely used sizes of both go and not-go plain plug and plain ring gages. Additional catalogs have recently been prepared for thread plug and thread ring gages for all standard series threads. Each gage listed has been assigned a stock number to tie in with the Defense Supply Management Agency program to establish one stock number for a commonly used item which is to be used by all services to effect maximum supply economy.

These Military Standards are already paying off in Ordnance in several phases of operation. The need for preparing an individual drawing of the gage has been eliminated since the designer now merely selects the proper stock number from the catalog and applies it to the gage list and his job is complete. This has saved considerable cost and manpower both at the arsenals and on contract design. Since copies of the Military Standards have been distributed to all normal suppliers of Ordnance gages it is now possible to process procurement by merely refering to the stock number and quantity required in invitations for bid. An overall ordnance stock control system for standard gages and measuring equipment has been established which serves to reduce the need for procurement as well as the overall ordnance inventory of these items. Copies of Military Standards pertaining to gages are available through the Superintendent of Documents, Washington, D. C., at a nominal cost.

CLOSURE

In summation, we feel that great strides have been made in the past decade in the art of inspection and gaging as applied in Ordnance. We like to feel that perhaps our program has had its impact on industry as a whole and that as the pendulum swings back industrial advances in the art of inspection through quality control will provide the basis for further reduction in the cost of acceptance inspection of Ordnance material.

Statistical Appraisal of Vacuum Tube Reliability

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In recent years the term "reliable vacuum tube" has come into widespread use. The need for this type of tube is generally conceded to be primarily military. The failure of a tube in guided missiles or bomber electronic gear may mean an ineffective missile or the destruction of a bomber as well as loss of life. Ineffective missiles and destroyed bombers cost tremendous sums of money. Hence, to the services, the term "reliable vacuum tube" implies that all tubes will operate under use conditions with stable electrical characteristics and no inoperative failures throughout a required time interval.

To meet the needs of the services, the radio tube industry has embarked on a reliable tube program. Realizing that it is impossible to make all tubes perfect, the tube industry has set goals on the rate of inoperative tube failure and stability of electrical characteristics to approach the military need. However, the every-tube-perfect ideas can only be approached asymptotically, as the risks inherent in any sampling plan allow some defective tubes to get out the door.

Tube reliability involves three basic concepts:

1. The establishment of the best design for a tube type
2. Elaborate process control at all points during the manufacture
3. An adequate acceptance procedure and specification for the finished tubes

One might question whether these concepts should not also apply to ordinary commercial tubes. Obviously, they do; however, economics must be considered in determining the degree to which the concepts are carried out. In comparing the two grades of tubes, more cost can be incurred to fulfill the three concepts in reliable tube manufacture.

Sylvania's approach to the third concept, the specification and acceptance procedure for the reliable tube program, is as follows.

The first step required to appraise tube reliability is a specification in which the various testing conditions and specification limits are defined. To set proper testing conditions and specification limits, the application of a tube type has to be reviewed with the users, and the process capabilities under various testing conditions have to be explored. Usually the application is the most important factor in setting specification limits; however, it is important to be aware of process capabilities before specification limits are established. Setting specification limits for characteristics distributed normally or non-normally will be discussed later in conjunction with acceptance procedure.

The general intent of the lot acceptance procedure is to accept initially each electrical characteristic individually, either by an attributes plan, or the combination of a variables plan and attributes plan. In this way important electrical characteristics may be controlled by tight operating characteristics and other less important electrical characteristics may be controlled by less severe operating characteristics. Electrical characteristics subject to acceptance by both variables and attributes are controlled not only for minimum and maximum, but also for production lot mean and standard deviation, thereby imposing strict requirements for the shape of the lot distribution inside the specification limits for the individual tubes. After production lot acceptance has been achieved on the individual characteristics, attributes plans covering groups of electrical

characteristics are employed to control total defects.

To elaborate on establishing specification limits and acceptance procedure, let us consider the electrical characteristic transconductance G_m on a typical reliable subminiature. This electrical characteristic is of critical importance for many vacuum tube types. A G_m rating of a typical reliable subminiature is 5000 μmhos. The figure 5000 is normally called "design center" or "bogey" for the characteristic. To set a minimum and maximum specification on individual tubes, daily samples of 24 are read for a 20-day period. It is assumed that prior to the 20 days the design and processing of the tube type has been settled and that the ensuing 20 days should exhibit a controlled process. The mean $\overline{X}$ and the best estimate of population standard deviation σ for each group of 24 is computed, using the range method to compute standard deviation. A pattern of $\overline{X}$ and σ values is plotted and examined for trend or change in level. Assuming that both statistics show control, the process average $\overline{\overline{X}}$ and the mean process standard deviation $\overline{\sigma}$ are computed. A desired condition is to find that the process average is located at bogey. If only the standard deviation exhibits control, specification limits may be established from the information; however, subsequent lot acceptance may be impaired if the mean can not be brought under control. Setting specification limits without standard deviation under control is not recommended.

The value of $\overline{\sigma}$ is utilized in establishing limiting values of population mean called LSLA, the lower specification limit for averages, and USLA, the upper specification limit for averages. LSLA and USLA are placed arbitrarily, with hindsight however at $1\overline{\sigma}$ below and above bogey respectively. Maximum and minimum values are placed K multiples of σ from the USLA and LSLA respectively, K representing the normal deviate and chosen so that the AQL value for the electrical item is included in each tail. Pictorially, assuming $\overline{\sigma} = 225$ in the transconductance example, the above appears as shown in Fig. 1.

Rounding off the maximum and minimum values computed statistically to more appropriate specification values, maximum is set at 5800 and minimum at 4200. Acceptance of these values as maximum and minimum would depend to some extent upon tube application; however, the values as established are considered indicative of process capabilities. The arbitrary choice of $1\overline{\sigma}$ for locating the limiting values of population mean has been developed by experience. Lot by lot pattern of mean and standard deviation over a two-year span on particular types shows process levels within the $\pm 1\overline{\sigma}$ from bogey to be compatible with practical operation.

The above procedure is used to set minimum and maximum on all important characteristics that distribute themselves normally. With minimum and maximum values thus established, attributes testing in general is administered by using plans from MIL-STD-105A. The basic philosophy for using MIL-STD-105A is the provision of large sample sizes which have operating characteristic curves with high discriminating power. Several electrical characteristics such as filament current, screen current, and plate resistance are subject only to control by attributes.

For some characteristics, such as transconductance, attributes control is not considered sufficient. Here, control on the mean and standard deviation is also provided to control the distribution shape of the final product inside of the specification limits for minimum and maximum. When a good distribution of tubes is achieved, the compound probability of finding maximum and minimum limit tubes in cascaded amplifier circuits is small. In this application and other circuits it is desirable to keep this probability small for efficient operation. The standard deviation to be controlled is defined as the maximum rated standard deviation, MRSD. MRSD is equated to 1.33 times the mean process standard deviation $\overline{\sigma}$. The control limit on MRSD is called ALD or acceptance limit for sample dispersion. ALD is computed so that the probability of acceptance is 95 percent for a production lot whose standard deviation is MRSD. When N = sample size

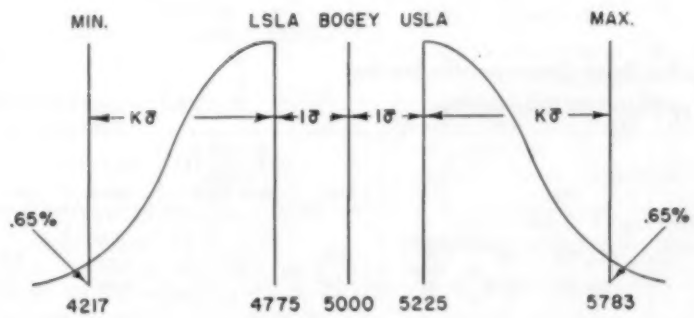
$$\text{ALD} = \text{MRSD} + 1.645\,\frac{\text{MRSD}}{\sqrt{2N}}$$

The control limits on the mean are called UAL and LAL or the upper and lower acceptance limits for sample mean. LAL and UAL are computed so that the probability of acceptance is 95 percent for a production lot whose mean is equal to LSLA or USLA.

$$\text{LAL} = \text{LSLA} - 1.645\,\frac{\text{MRSD}}{\sqrt{N}}$$

$$\text{UAL} = \text{USLA} + 1.645\,\frac{\text{MRSD}}{\sqrt{N}}$$

The constant 1.33 above has been selected to insure that a production lot made up of sub-lots whose means extend from LSLA to USLA will not be rejected for standard deviation unless the average standard deviation of the sub-lots exceeds $\overline{\sigma}$. It is realized, however, that a production lot with mean located at USLA or LSLA could be accepted with a standard deviation MRSD but would violate the specification requirements for minimum or maximum. In such instances an attributes plan would likely reject the lot. The constant is realistic but somewhat arbitrary, as it is dependent upon the number and position of sub-lot



AQL = .65%, K = 2.48
MIN = LSLA − Kσ
MIN = 4775 − (2.48)(225)
MIN = 4217

AQL = .65%, K = 2.48
MAX = USLA + Kσ
MAX = 5225 + (2.48)(225)
MAX = 5783

Figure 1—Specification Limit Chart for Vacuum Tube Transconductance

means located with the interval $\pm 1\bar{\sigma}$ from bogey that may be represented in a production lot or the number of sub-lot means within the interval $\pm 1\bar{\sigma}$ that may be represented in a warehouse full of production lots. A detailed mathematical treatise supporting the choice of this value is covered by an unpublished paper—"Maximum Rated Standard Deviation," dated September 5, 1952, by D. R. Meierdiercks.

Because of the variables control, one might think that attributes inspection is an unnecessary item. One reason has been pointed out why the attributes control is also a necessity. Another reason for the necessity of supplementary attributes control is that an occasional lot will have an unsymmetrical distribution form resulting from assignable causes.

Characteristics which have inherently non-normal distributions are inspected only by attributes plans taken in general from MIL-STD-105A. Most of these characteristics have J-shaped distributions. Specification limits are established on J-shaped characteristics by evaluating composite data taken over a period of time. A limit is arbitrarily selected which has a percentage of individual readings outside. This percentage is usually near the AQL value desired on the characteristics. Tube application is also of major importance in setting these limits.

Consequently, a general picture of the initial acceptance procedure finds normal and non-normal electrical characteristics controlled individually by attributes. Certain critical characteristics simultaneously use variables control with attributes control.

Lots rejected by variables control constitute a problem to the producer. Sometimes reprocessing is the answer; however, if this is not feasible salvage of good tubes becomes the problem. Obviously, merely re-screening the lots to maximum and minimum will not make them acceptable. Re-screening, however, to calculated limits inside maximum and minimum will accomplish this job. A paper on truncation of rejected lots is to be published in the near future by G. V. Herrold of Sylvania.

Even though vacuum tubes meet initial acceptance procedure they are expected to give serviceable performance through a time interval. Hence, life testing of vacuum tubes is as important as initial acceptance procedure. Commercial tube life tests are accepted by a procedure under which defects of critical importance are not differentiated from the less important defects. Adding more types of defects to a life testing specification can be accomplished usually at the expense of loosening acceptance criteria and at the same time giving less importance to the more critical defects. Consequently, it became mandatory that a reliable tube life testing specification be developed to overcome these difficulties.

The general intent of the lot acceptance procedure on life is to have a tight control on inoperatives and transconductance slump with somewhat looser controls on other characteristics. End-point specification limits for the various characteristics on life were determined in general in accordance with the previously mentioned methods.

To elaborate on the life testing procedure, a 150-tube sample, all tubes meeting initial specification (MIL-STD-105A lot size 1301—3200), is carried through 100 hours life and a 20-tube sample selected from the 150-tube sample is life tested 400 additional hours. The 20-tube sample is earmarked for the 500-hour test at the beginning of the life test. The first inspection takes place at one hour on ΔG_m for the individual tubes in accordance with MIL-STD-105A plan at 10% AQL. Rejection at this point disposes of the lot for reprocessing.

The second inspection takes place at 100 hours where the 150-tube sample is required to meet a 0.4% AQL on inoperatives and a 1.0% AQL on a transconductance end-point. Because of the large sample size at this point, the high discriminating power of the OC curve gives excellent protection against allowing bad lots for these two items to pass. Hence, acceptance at this point gives sufficient information to continue life testing on a 20-tube life sample. Final acceptance is based on the 20-tube sample as of 500 hours life, the 500 hours including 100 hours as part of the 150-tube sample. At 500 hours inoperatives and electrical characteristic failures are accepted by individual acceptance numbers and a combined acceptance number for total defective tubes. Failure to pass the individual criteria or the combined criteria will cause lot rejection. A lot may also be rejected at a 300-hour reading interval if the 500-hour requirements are violated at this point. Again at these two points the controls for the various items are relative to the importance of the item, inoperatives receiving the most stress. The end-point characteristic section of a typical intermittent life test specification, type 5840, is shown in Table I.

TABLE I—End-Point Characteristic Section

Type 5840 Life Specification

CHARACTERISTICS (Note 17) Intermittent Life Test (1) End-Points	Conditions	Unit		Insp. Level	AQL	Allowable Number of Defects Per Char.	Min.	Max.
One Hour Test—Sample A								
Transconductance change of individual tubes from initial	E_f = 6.3V	ΔG_m (1)	%	Note 20	10.0		....	8.0
100 Hour Tests—Sample A				Note				
Transconductance (1)		G_m (1)	μmho	20	1.0		3250	..
Inoperatives (Note 19)				II	0.4			
300 and 500 Hour Tests Sample B (Note 18)								
Inoperatives (Note 19)						1		
Heater Current		I_f	mA			4	135	165
Heater-Cathode Leakage (1)	E_{hk} = +100Vdc	$+I_{hk}$	μAdc			2	....	10
Heater-Cathode Leakage (2)	E_{hk} = −100Vdc	$-I_{hk}$	μAdc			2	....	10
Grid Current (1)		I_c (1)	μAdc			2	....	−0.3
Grid Current (2)	E_f = 7.0V	I_c (2)	μAdc			2	....	−1.0
Transconductance change of individual tubes from initial	E_f = 6.3V	ΔG_m (1)	%			1	....	25
Transconductance change of individual tubes from E_f = 6.3 to E_f = 5.7		ΔG_m (2)	%			4	....	15
Electrode Insulation, g-all		Rg-all	Meg			4	50	..
Electrode Insulation, p-all		Rp-all	Meg			4	50	..

The life test specification shows the test, test conditions, inspection level, AQL, and minimum and maximum limits. The points of interest on the specification are the 0.4% AQL on inoperatives at 100 hours, the control of ΔG_m at one hour and the list of acceptance numbers on the various characteristics at 500 hours. It might also be pointed out that Note 18 referred to on the 300- and 500-hour tests states that no more than the four defective tubes are allowed on the 300- or 500-hour test.

To conclude, an attempt has been made to establish realistic specification limits compatible with process capabilities and tube application. Attributes testing initially and on life on all important items has been made by sampling plans with high discriminating power. Major characteristics initially have controls on mean and standard deviation that control the shape of the distribution of final product within specification limits. The life test has been established to give a high degree of protection against passing lots having excessive inoperative failure rate and to control major electrical characteristics individually. Although the every-tube-perfect goal cannot be literally achieved, it is still being approached.

Bibliography

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APPLICATION—CHEMICAL INDUSTRY

ATOMIZATION OF LIQUIDS BY SUPERSONIC AIR JETS, M. D. Betron, Weizmann Institute.
(Industrial and Engineering Chemistry—v. 47, n. 1, Jan. 1955, p. 23)

This paper presents an experiment on sprays produced by supersonic gas atomization. Material was sprayed through high velocity jets and the drops collected on a slide and measured for diameter with a microscope. Drop size distributions were compared with an expected distribution. Histograms and functions of the observed distributions were compared with that expected.

Chi square was used to check goodness of fit between the observed and the expected distribution.

APPLICATION—TEXTILE INDUSTRY

MODERN MILL ORGANIZATION, Norbert Lloyd Enrick
(Modern Textiles Magazine—v. 36, n. 1, Jan. 1955, p. 31)

This article is the first of a current series indicating the importance to quality control of an overall organizational set up. Relationships between the various activities in an organization to a large extent set the pattern for the conditions under which quality control, as well as every other function can achieve its purpose. The overall planning and considerations are discussed in this article, which is illustrated with numerous charts. Of particular importance, is the need for standards and the coordination of standards throughout the organization.

HOW THE CONTROL PROGRAM OPERATES, Norbert Lloyd Enrick
(Modern Textiles Magazine—v. 36, n. 2, Feb. 1955, p. 49)

The second article in Mr. Enrick's series discusses the control laboratory and overall testing program needed to assure the maintenance of desirable quality. Problems of test, frequency, schedules, and recording test data as well as the control of production wastage are presented.

APPLICATION—MISCELLANEOUS

QUALITY CONTROL OF PURCHASED MATERIALS, Stephen J. Rogers, Manager, Material Quality Section, Ford Division Ford Motor Co.
(Steel—v. 135, n. 10, Sept. 6, 1954, p. 92)

In view of the fact that the cost of materials is by far the greatest part of manufacturing cost, the control of quality and of disposition of purchased materials is presented as a most important area of quality control. This article briefly outlines some of the thinking underlying the receiving inspection techniques employed at the Ford Motor Co., Ford Division, Detroit, Mich.

APPLICATIONS OF SOME STATISTICAL QUALITY CONTROL TECHNIQUES IN THE MANUFACTURE OF VENEERS AND PLYWOOD, Edward P. McMahon, Nickey Bros. Inc., Memphis, Tenn.
(Journal of the Forest Products Research Society—v. 4, n. 5, Oct. 1954, p. 373)

The probability aspects of process control are discussed to introduce control charts and their characteristics. Examples of p, and $\bar{X}$ and R charts are given as used to control moisture content, thickness, waste, and percent defective. Several charts are included to show data obtained for process control. Emphasis is placed on the benefits resulting from the use of statistical analyses and especially control charts.

DIMENSIONS AND TOLERANCES FOR MACHINED FURNITURE PARTS, James S. Bethel, and Robert J. Hader, North Carolina State College, Raleigh, N. C.
(Journal of the Forest Products, Research Society—v. 4, n. 5, Oct. 1954, p. 365)
Provides a brief discussion of the significance of tolerances and of

Selected references in the Bibliography of *Industrial Quality Control* are obtained from the following sources:

The International Statistical Institute, *International Journal of Abstracts on Statistical Methods in Industry.*

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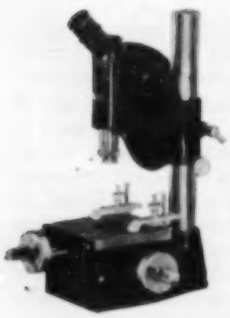

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Quality Control

INSTRUMENTS

precision in machining wood. The paper cites the need for specification of dimension tolerances and demonstrates the importance in mating parts. The use of control charts for obtaining accurate machine set-up is shown. By using analysis of variance methods it was found that excessive dimension variation was due to incorrect machine set-up. Shows how Burr's reset-run card, a sequential plan, can be used to provide accurate set-up.

STATISTICAL QUALITY CONTROL FOR PLATER, J. B. Kushner
(Metal Finishing—v. 52, n. 9, Sept. 1954, p. 64.)

This article presents the idea that Statistical Quality Control is applicable only where a large quantity of a single item is produced. The establishment of operating limits are discussed along with other basic principles and approaches. This article is illustrated with an example of a production job involving plating of a complicated shape with silver.

ENGINEERING & EXPERIMENTS

REDUCING THE HIGH COST OF INFORMATION BY USING THE STATISTICAL APPROACH TO RESEARCH, Ben S. Bryant, Univ. of Washington, College of Forestry, Seattle, Wash.
(Journal of the Forest Products Research Society—v. 4, n. 5, Oct. 1954, p. 322)

This paper is a discussion of general considerations in regard to obtaining information for industrial operations. The cost of information and the use of statistical analyses in research are dealt with. Examples are given of the kinds of problems that should be analyzed statistically with indications of the benefits to be expected. The examples consist of statements of typical problems in wood processing and the approach to selecting a suitable testing method.

COMPARISON OF FOUR NATIONAL RADIUM STANDARDS
Part 1. Experimental Procedures and Results
Part 2. Statistical Procedures and Survey
(Journal of Research of the National Bureau of Standards—v. 53, n. 5, 1954, p. 267)

Part 2 of this article was written by W. S. Connor and W. J. Youden and discusses a statistical analysis of the four National Radium Standards described in part one. Readings made by several methods are

adjusted to provide basic relationships between the masses and the radioactive effects of the radium standards.

MANAGEMENT & PERSONNEL—GENERAL

QUALITY, Roscoe M. Smith, Director of Quality Control, Ford Motor Co.
(Production—v. 35, n. 1, Jan. 1955, p. 69)

The author very briefly summarizes the place and value of quality control at the Ford Motor Company.

(This issue of "Production" also contains a round table discussion by automotive executives on "Cut Costs—Maintain Quality.")

INDUSTRIAL MANAGEMENT

MANAGEMENT CONSIDERATIONS IN PRODUCTION QUALITY CONTROL, Charles A. Bicking, Office, Chief of Ordnance, Washington, D. C.
(Steel Processing—v. 40, n. 10, Oct. 1954, p. 645)

The application of quality control methods to production control includes an extension to technical activities of administrative sensitivity to work fluctuations in economic and human factors of business. Typical examples of the cost of off-guide material are given. The various ways in which savings may be experienced are summarized. Examples are given of savings due to the reduction in dust losses in a pulverizing operation, savings due to the reduction in testing in laboratory control of a batch operation, and savings due to revised operating procedures in a pilot scale investigation of a catalytic reaction. A discussion is included of what statistical methods add to technical control of a process. The article concludes with a step by step outline of the conduct of a successful quality control program.

MISCELLANEOUS

OBSERVATIONS ON THE APPLICATION OF STATISTICAL TECHNIQUES TO ASTM STANDARDS, Charles A. Bicking, Office, Chief of Ordnance, Washington, D. C.
(ASTM Bulletin, No. 200, Sept. 1954, p. 48)

This is a report on the results of survey of the statistical content of ASTM Standards. A complementary paper published in the same month in *Industrial Quality Control* describes similar results of work of other organizations in the

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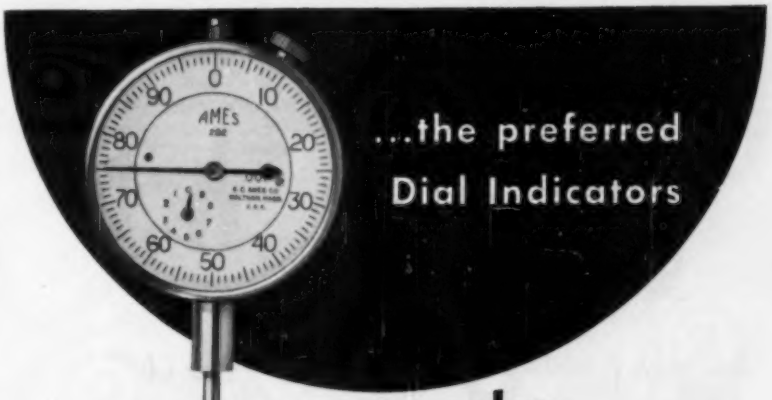

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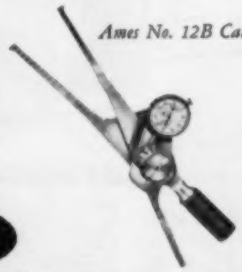
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United States. Examples were chosen so as to show a gradually increasing awareness of the need in standards, of more explicit statistical treatment of data and for clearer definition of terms. Precision and accuracy definitions, in particular, are given attention and examples are provided from standards in the fields of emission spectroscopy water hardness determinations, petroleum analysis, and textile testing. Another statistical aspect of standards is in the sampling criteria involved and an example is given from the sampling of wire for electrical conductors. The article concludes with an appendix giving sources of standards and a list of references to ASTM Publications on various aspects of use of statistics in ASTM work.

QUALITY REPORTING

AUDITING QUALITY IN WOOD PRODUCTS MANUFACTURE, James S. Bethel, North Carolina State College, Raleigh, N. C. (Wood Working Digest—v. 56, n. 6, June 1954, p. 147)

Compares quality survey with commercial audit. States the evaluation should be concerned with: 1) Specification of quality, 2) Actual status of quality, 3) Procedure for policing quality. Cites a case in wood products manufacturing plant where the advertised specifications, executive statements on quality standards, and production superintendent's understanding of quality requirements all differed from the actual quality of product. Best solution is seen to be in written description and/or blue print. An audit of current quality of materials, processes and products is believed necessary as a result of creeping changes that go unnoticed. Procedure for policing should be audited to determine the status of inspection tools and the actual allocation of the quality control function.

STATISTICS

SOME THEOREMS RELEVANT TO LIFE TESTING FROM AN EXPONENTIAL DISTRIBUTION, by B. Epstein and M. Soebel (Annals of Mathematical Statistics—v. 25, June 1954, p. 373)

ESTIMATION OF CORRELATION COEFFICIENTS FROM SCATTER DIAGRAMS, G. R. Sugar (Journal of Applied Physics—v. 24, n. 3, Mar. 1954, p. 354)

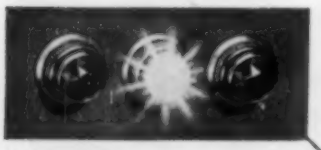
EXPERIMENTS WITH A RANDOM SELECTOR AS AN AID TO THE TEACHING OF STATISTICS, E. A. G. Knowles (Applied Statistics—v. 3, June 1954, p. 90)

CONSTRUCTION OF NOMOGRAMS FOR USE IN STATISTICS, PART I. TRUE AND EMPIRICAL NOMOGRAMS, P. Lyle (Applied Statistics—v. 3, June 1954, p. 116)

CHAIN BLOCK DESIGNS WITH TWO-WAY ELIMINATION OF HETEROGENEITY, John Mandel, National Bureau of Standards (Biometrics, June 1954, p. 251)

REPORTED—NOT REVIEWED

METHOD OF AVERAGES AND ITS COMPARISON WITH METHODS OF LEAST SQUARES, H. Morouchow (Journal Applied Physics—v. 25, n. 10, Oct. 1954, p. 1760)



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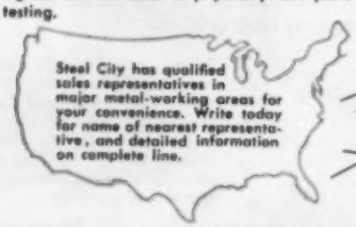

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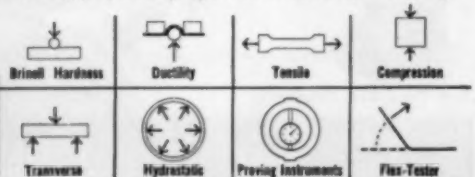

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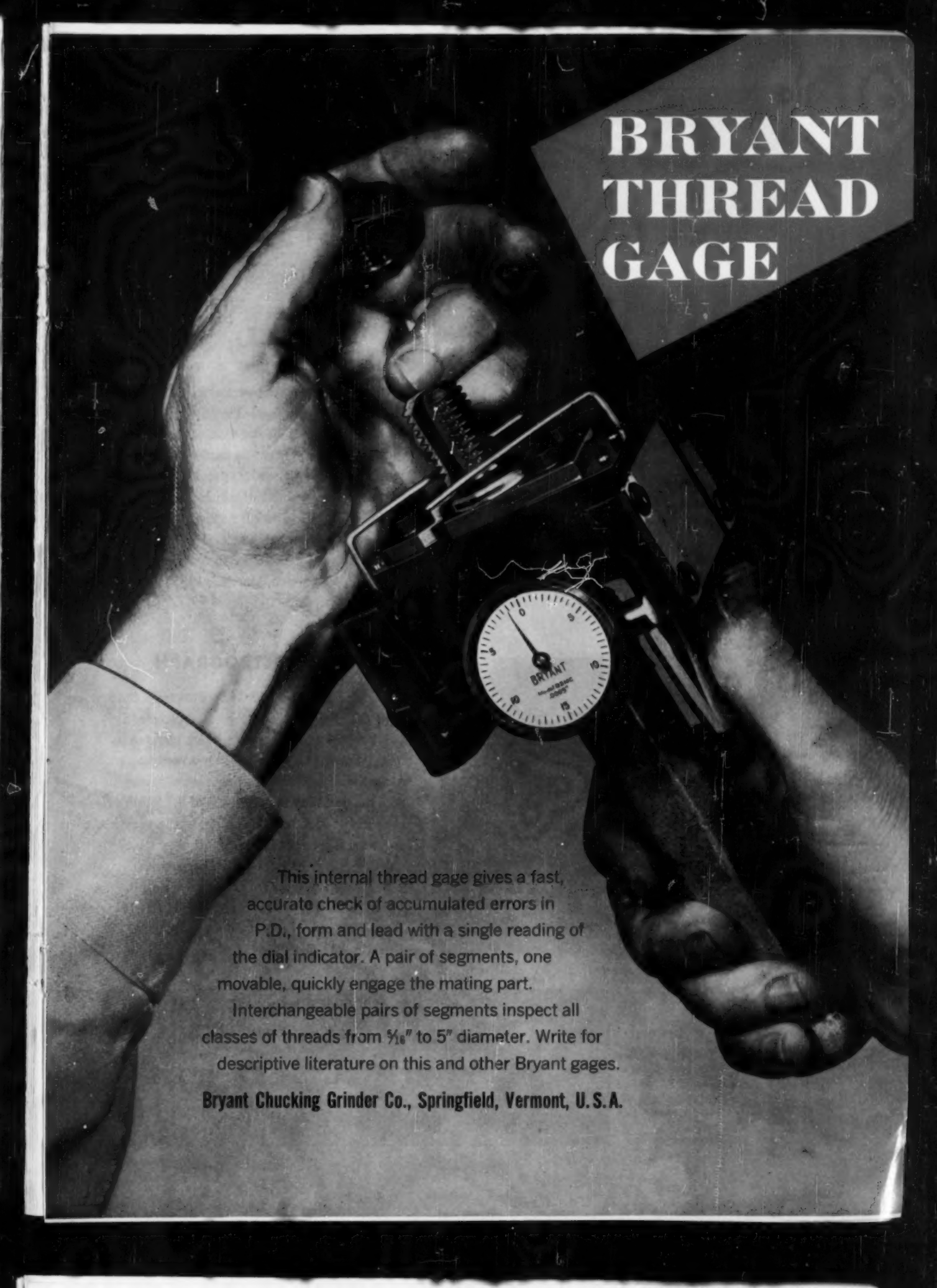

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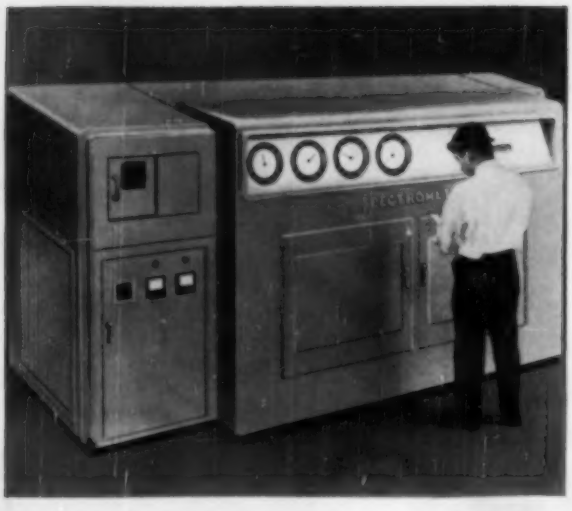

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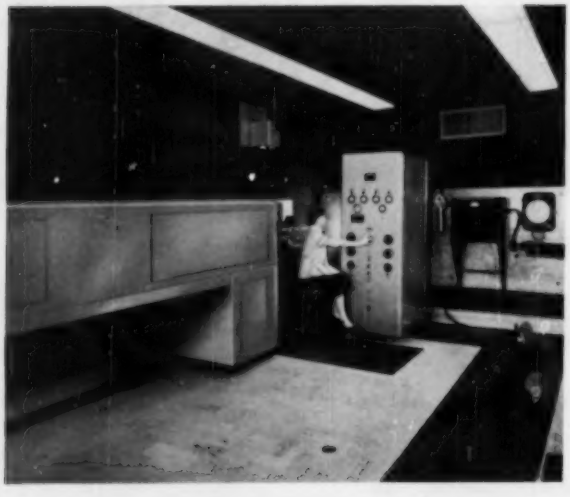

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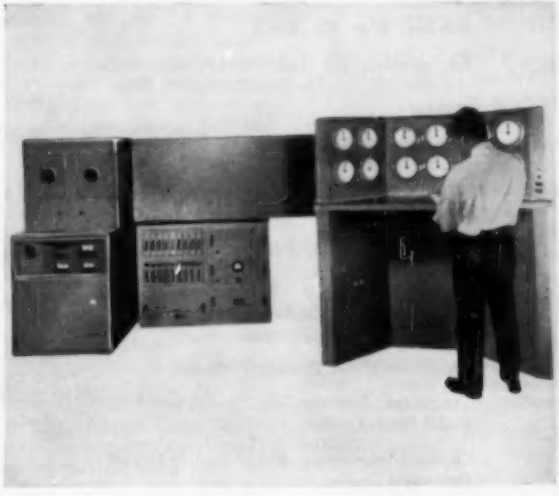

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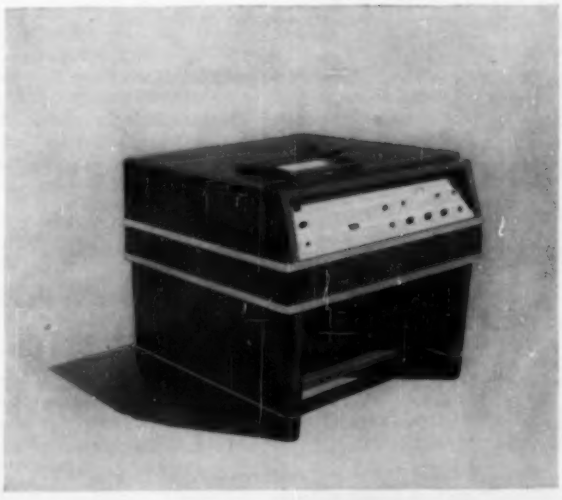

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8:00 am	Registration—Hotel Statler Mezzanine and Hotel New Yorker Mezzanine (One day cash registrations only)
8:30 am-12:15 pm	Exhibits—Hotel Statler Mezzanine
9:30-11:30 am	Technical Sessions—Hotel Statler and Hotel New Yorker
12:15 pm	General Luncheon—Hotel Statler Grand Ballroom
12:15 pm	Chemical Division Luncheon—Hotel New Yorker Terrace Room
1:15-8:00 pm	Exhibits—Hotel Statler Mezzanine
2:00-4:00 pm	Technical Sessions—Hotel Statler and Hotel New Yorker
4:00 pm	Annual Meeting, ASQC—Hotel Statler Skytop
8:30 pm	Social Evening—Hotel Statler Grand Ballroom

Tuesday, May 24, 1955

8:30 am	Registration—Hotel Statler Mezzanine and Hotel New Yorker Mezzanine (One day cash registrations only)
8:30 am-12:15 pm	Exhibits—Hotel Statler Mezzanine
9:30-11:30 am	Technical Sessions—Hotel Statler and Hotel New Yorker
12:15 pm	General Luncheon—Hotel Statler Grand Ballroom
12:15 pm	Textile Division Luncheon—Hotel New Yorker Terrace Room
1:15-6:00 pm	Exhibits—Hotel Statler Mezzanine
2:00-4:00 pm	Technical Sessions—Hotel Statler and Hotel New Yorker
6:15 pm	Annual Banquet—Hotel Statler Grand Ballroom

Wednesday, May, 25, 1955

8:30 am	Registration—Hotel Stattler Mezzanine and Hotel New Yorker Mezzanine (One day cash registrations only)
8:30 am-12:15 pm	Exhibits—Hotel Statler Mezzanine
9:30-11:30 am	Technical Sessions—Hotel Statler and Hotel New Yorker
12:15 pm	General Luncheon—Hotel Statler Grand Ballroom
12:15 pm	Metals Technical Committee Luncheon—Hotel New Yorker Terrace Room
1:15-5:00 pm	Exhibits—Hotel Statler Mezzanine
2:00-4:00 pm	Technical Sessions—Hotel Statler
5:00 pm	Convention Closes

LADIES' PROGRAM

Monday, May 23, 1955

9:00 am	Coffee Hour—Hotel Statler Penn Top North
1:30 pm	Radio, television programs and short tours available
2:30 pm	Guided cruise around Manhattan (Alternate tour may be selected for 1:30 pm Wednesday, if desired)
8:30 pm	Social Evening—Hotel Statler Grand Ballroom (Not included in Ladies' Registration; tickets may be secured separately)

Tuesday, May 24, 1955

9:00 am	Coffee Hour—Hotel Statler Washington Conference Room #2
11:30 am	Luncheon — Continental Room, Brass Rail Restaurant, 7th Ave. at 49th St.
2:30 pm	Guided tour of United Nations Bldg.
6:30 pm	Annual Banquet—Hotel Statler Grand Ballroom (Not included in Ladies' Registration; tickets may be secured separately)

Wednesday, May 25, 1955

9:00 am	Coffee Hour—Hotel Statler Washington Conference Room #2
1:30 pm	Guided tour of downtown Manhattan (Alternate to cruise given 2:30 pm Monday. If both tours are desired, indicate this on registration form and an extra charge will be made at time of arrival.)

For additional information about the convention or for registration forms write to Allan R. Crawford, University College, Rutgers University, New Brunswick, N. J.

Ninth Annual Convention Exhibit Descriptions

Booths 10-11

AMERICAN CYSTOSCOPE MAKERS, Inc.

American Cystoscope Makers, Inc. extends a cordial invitation to visit their exhibit of industrial inspection telescopes (borescopes) in booths 10 and 11. Representatives in attendance will be glad to demonstrate these instruments and discuss any of your visual inspection problems.

Booth 13

MARCHANT CALCULATORS, Inc.

An interesting and outstanding example of the successful application of statistical quality control is provided by the production operations of this pioneer calculator manufacturer. That example will be presented in graphic form by the Marchant exhibit.

The display will include much of interest to QC men—blow-ups of Marchant's quality control charts, photographs of factory scenes showing SQC in action, and some of the actual calculator parts and assemblies to which the charts and pictures pertain.

A 52-page booklet forming a case history of Marchant's application of statistical quality control—virtually a textbook—will be available free of charge.

Visitors in the Marchant booth will see demonstrations of the specialized use of Marchant calculators for statistical quality control figurework. Marchant has developed comprehensive calculating methods especially for the use of QC personnel. These methods also are available in printed form, free of charge.

The Marchant line of calculators on display will include the "Live Tab" Figuremaster, a model of particular utility for SQC calculations.

Booths 14-15

BAUSCH & LOMB OPTICAL CO.

Bausch & Lomb Optical Co. will show a complete line of optical quality control instruments. Featured will be the bench comparator and the new models of stereomicroscopes. The former has established itself as a recognized factor in economical, convenient, precise on-the-line control instrument.

The stereomicroscope line has been doubled to include models for every requirement of industrial use in routine assembly and inspection operations.

Other Bausch & Lomb instruments to be demonstrated are the shop, brinell and wide-field tube microscopes.

Booth 16

THE VAN KEUREN CO.

The Van Keuren Co., of Watertown, Mass., manufacturers of precision measuring equipment for 35 years, will feature in Booth No. 16 at the ASQC exhibit, monochromatic lights, fused quartz optical flats (accurate for flatness to .000001 of an inch, in sizes from one inch to ten inches in diameter) and a new line of chrome-carbide taper lock plug gages in XXX tolerance.

The 0-3" light wave micrometer, which makes direct measurements to .000010 of an inch, will also be shown. A complete line of gage blocks, cylindrical standards, measuring rolls, root diameter wires, taper lock plug gages, thread measuring wires and micrometer lapping and testing equipment will be displayed.

Other products to be on exhibition are steel and tungsten carbide wire type plug gages, chromium plated wires, steel and tungsten carbide wire type plug gages, chromium plated wires, steel optical flats and calibrated steel balls.

Booth 17

THE JOHNSON GAGE CO.

Featured by The Johnson Gage Company, will be the screw thread analyzer, a combination of two separate purpose comparators—the Model BG RING-Snap thread comparator and the Model CN ROLL-Snap thread coparator.

The former gives a composite reading of all the thread elements collectively, thereby revealing the exact condition of "assembly-ability" of the thread, while the latter gives check of pitch diameter only in a single element. Thus, the exact fit of the thread with its components, and accuracy of the several elements—pitch diameter, lead, roundness and straightness—are all quickly and accurately revealed.

Booth 18

PERKIN-ELMER CO

Perkin-Elmer will feature the Model 118 angle comparator and Model 11 machine tool microscope.

The Model 118 angle comparator is an inspection tool for comparing angles, parallelism and squareness. It is designed to speed quality control and production inspection. The angle comparator is an optical instrument which uses light to give precise measurements independent of environmental conditions, physical pressure or "feel" of the inspector.

The Model 11 machine tool microscope is an optical locating, inspection and measuring instrument for all vertical or horizontal machine tools. It offers the most accurate and quickest way of locating a workpiece on a table, locating holes and contours for machining and inspecting a machined workpiece.

The precise and quick approach of the machine tool microscope avoids use of the classical methods of gaging and indicating and permits location and inspection in places inaccessible by other means.

Booth 25

AMERICAN OPTICAL CO.

American Optical's Instrument Division, occupying booth #25 will display a selected group of microscopes for industrial and laboratory use, including polarizing, metallurgical, stereoscopic and phase.

A new item on display will be the 507 polarizing attachment for stereoscopic microscopes which extends the usefulness of this very popular inspection instrument. Proper microscopic illumination will be demonstrated with the use of two types of illuminators, both incorporating focusing condensing systems. Also on display will be a refractometer, precision engineered to give quick determinations of the refractive index and dispersion of liquids and solids.

How To Make Gages With Millionths-Accuracy in Minutes!
Use the DoALL Micro-Step Gaging System
Countless Gages including indicating types made with Micro-Step instruments
Fully exposed end measuring surfaces.
FREE DEMONSTRATION and literature on request.
Call your DoALL Service-Store
SELECT END STANDARD from Micro-Step Set.
ASSEMBLE — place gage blocks into channels; snap pins through end standards.
TIGHTEN CLAMPS —that's all there is to it!
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DoALL SAW BANDS
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Machine Tools • Cutting Tools • Measuring Instruments
Tool and Die Steel • Shop Supplies • In Stock
The DoALL Company, Des Plaines, Ill.

Representatives of A. O.'s Instrument Division will be present to demonstrate the instruments and answer questions regarding them.

Booth 26

ELLIOTT SERVICE COMPANY

Featured at the Elliott Service Company's display will be the following management services:

1. Colorful "Quality-Cost" Displays for weekly departmental posting in large and small manufacturing plants to help stimulate employee quality consciousness.

2. A complete bulletin board display service to reinforce management's daily contact with employees. This display features colorful, weekly poster presentations of those subjects requiring plant-wide cooperation, such as Quality Workmanship, Waste and Cost Reduction and Accident Prevention. Special posters are available for the Textile industry. Bulletin display boards are furnished in silver-gray, hammered-tone, or green baked-enamel finish.

3. Samples of "MANAGEMENT INFORMATION for Foreman and Supervisors," a weekly bulletin covering Quality Maintenance, Waste and Cost Reduction, Human Relations, Supervisor's Personnel Functions, Training, Safety. Also samples of Supervisory Outlines and booklets on similar subjects.

DoALL OPTICAL FLATS
for Checking Flatness, Size and Parallelism
A size and type for every job
• Purest Quartz
• Accuracies to .000001"
• Diameters to 10"
• Special sizes, shapes made to order
Ask about DoALL Monolights—2", 5", 20" sizes
DoALL OPTICAL FLATS
ALL SIZES
Consult classified directory for the DoALL Sales-Service Store near you
Call Your DoALL Service-Store
DoALL SAW BANDS
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INDIVIDUAL WORKING FLATS
2" x 8" x 12" BLACK GRANITE
Machine Tools • Cutting Tools • Measuring Instruments
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14

4. Elliott Suggestion System Service samples, which include weekly THINK-Stimulator displays, suggestion panel boxes and monthly Suggestion Bulletins.

Booth 28

THWING-ALBERT INSTRUMENT CO.

Featured in the Thwing-Albert Instrument Company exhibit is the Model 49RC electro-hydraulic tensile strength tester—a tensile tester which has been adapted for statistical quality control. Its automatic features have enabled industry to adapt it not only for routine tests but also where a rapid succession of tests are required for statistical control. Tests can be run quickly, yet with laboratory accuracy, by production personnel right in production areas. Not only does the chart line provide indisputable record of test results but for statistical work both high, average and low readings can quickly and easily be checked.

While the 49RC is simple and rapid for routine production its operating principles provide almost unlimited flexibility for the research laboratory. Pulling speeds can be adjusted infinitely between 0.1 inch and 25 inches per minute to meet the requirements of the material being tested. Load ranges are available from 10 grams to 500 pounds on the same instrumepts. With the 49RC it is possible to run tests for possible tensile strength, compression, relaxation, cycling under limits of load or extension hysteresis, work recovery, fatigue or combinations of the foregoing. It can be made either as simple or complex as required, complexity meaning the variety of tests the instrument is designed to do. The operation is always simple.

Also to be exhibited are the Handle-O-Meter, the Clark Softness-Stiffness Tester, the always useful Elmendorf Tearing Tester and the JDC Precision Sample Cutter.

Booth 31

SCALE SPECIALTIES & SYSTEMS, Inc.

We plan to display three actively operating "Datamatic Weight Calculators," each being equipped with a different over-under check-weigh scale. Each unit will be automatically graphing, averaging and totalizing the package weights placed by visitors or our people. The units will be tailor built to average each in a different sample lot size. We will also display our new "CURVO-MATIC" which will be steadily producing a percentage or count frequency curve from one "Datamatic." Many new features have been added to our standard "Datamatic" unit.

We will have two people attending the booth: Mr. L. F. Hansen and Mr. Donald A. Hansen.

Booth 32

KARL HEITZ, Inc.

The Karl Heitz Co. will have on display at Booth 32 several imported Swiss precision instruments for optical and photographic use in industry. Some of the instruments on display will be the Kern Swiss super-stroboscope recording camera, Projectina combination macro microscopic viewer-projector-camera, Omag pocket microscope, Kern Swiss prism binocular microscope, Kern Swiss optical flats and Alpa camera.

Booth 47

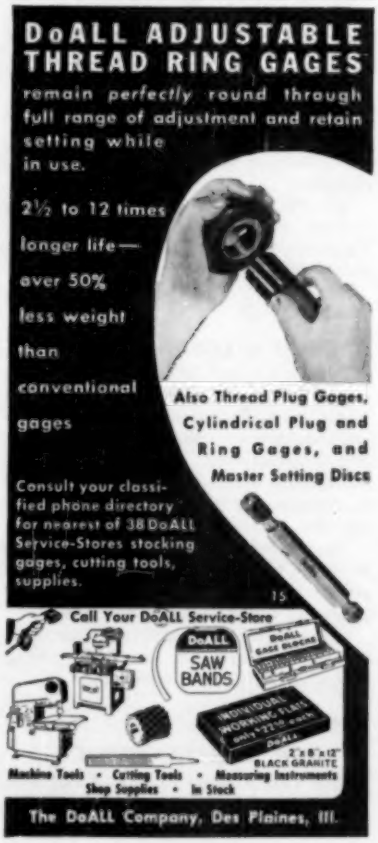
NATIONAL "U" ASSOCIATION

This exhibit will highlight two central features of the "U" Program for Quality.

1. The display and distributive materials for creating a plant-wide climate of individual enthusiasm and personal responsibility for Quality work.

2. The new techniques of two-way communication between management and workers, aiding employees to rid themselves of their Quality questions and problems while contributing their Quality ideas to more effective production.

Under the direction of Ralph E. Burt, President of the Association, the "U" staff will demonstrate how these materials and techniques are being employed within various industries to cut production costs through providing quality control engineers with tested promotional means for enlisting more successful employee effort.


DoALL ADJUSTABLE THREAD RING GAGES
remain perfectly round through full range of adjustment and retain setting while in use.
2½ to 12 times longer life—over 50% less weight than conventional gages
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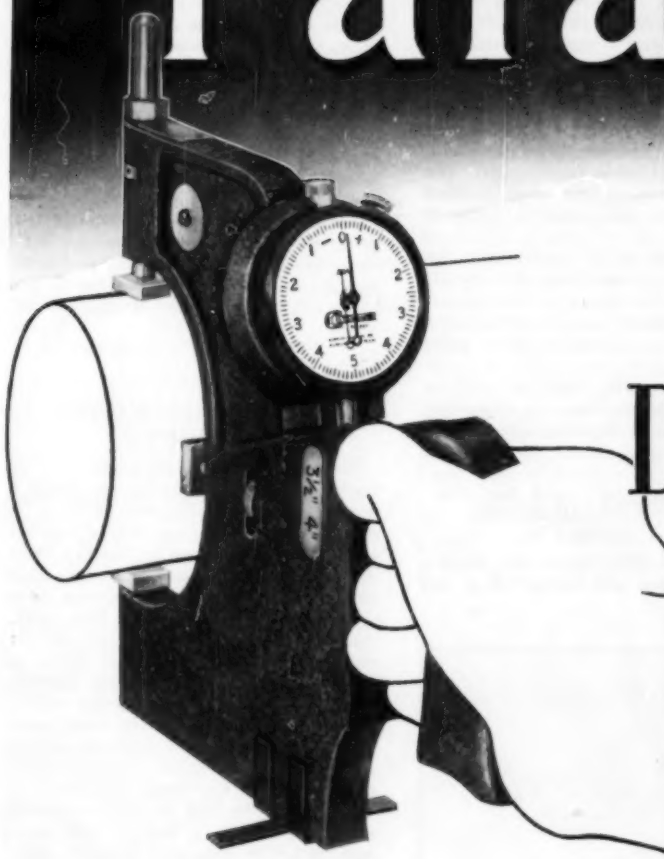
STANDARD

Paralloc

"L" Type Dial Snap Gage

PATENTED



RANGE OF SIZES
14" down to 0"

HERE is a modern, heavy-duty dial snap gage, light in weight, rugged in construction, designed for the toughest of long-run jobs.

The "L" Type utilizes Standard's Paralloc pin locking mechanism, which accurately maintains the parallelism of the anvil faces throughout the range of adjustment to a degree heretofore not available in this type of gage.

Eight sizes cover from 0 to 4 inches, each having ½" range of adjustment. Above 4 and up to 14 inches, each size has 1-inch range. Anvils are faced with tungsten carbide, and backstops are of nylon (except 0" - ½"). User may choose from a variety of indicator sizes and graduations. Retracting levers and tolerance hands are also available.

Write for complete information.

STANDARD GAGE COMPANY, INC.

POUGHKEEPSIE, N. Y., U. S. A.

Booth 48

STEEL CITY TESTING MACHINES, Inc.

Steel City Testing Machines, Inc., will exhibit, in operation, representative items from their line of machines for testing physical properties of metals. One of the featured items of this booth will be a dramatic display illustrating the outstanding features of Steel City's new "Color-Glance" Brinell Hardness Testing Machine, which is designed for high-speed production testing. While this new machine, unfortunately cannot be shown in the limited space available, illustrations will be on hand to show typical applications for completly automatic Brinell hardness testing.

Physical testing machines which will be in operation include a ductility testing machine (cup tester), a bench model Brinell hardness testing machine, a portable Brinell hardness tester, proving rings of various capacities and the revolutionary Flex-Tester for testing drawing qualities and stretcher strain characteristics of sheet metal.

Booth 49

J. W. DICE COMPANY

A number of non-destructive testing and measuring instruments for quality control will be exhibited by the J. W. Dice Company. In operation will be the following:

Electronic Micrometers—These instruments are direct measuring devices with extremely high accuracy. Three models for use on conducting materials exercise no measuring pressure whatsoever. One model is available for measuring thin films, resilient and non-conducting materials.

Ultrasonic Metroscope — Instrument for measuring wall thickness when there is access to one side only. Instrument also detects certain internal defects non-destructively in metals and other materials.

Automatic Cyclograph—Non-destructive high-speed sorting of metals and metal parts by analysis, heat treatment, hardness, depth of case or decarb, etc. Unscrambles raw material or finished parts mix-ups and insures uniform quality.

Microhm Meter — Instrument for checking surface resistances of materials and other low resistance measuring applications. Widely used for measuring "cleanliness" of aluminum sheet prior to welding.

Other instruments featured will be metal detectors, fluoroscopic inspection equipment and dye penetrants.

Booth 50

FRIDEN CALCULATING MACHINE CO.

The Friden fully automatic Square Root Calculator will be exhibited and demonstrated on quality control problems, including correlations, analysis of variance, moving averages, standard deviation, correlation coefficient, cube root and fully automatic square root.

The Friden is the world's first and only desk calculator with automatic square root. It provides fully automatic extraction of square root plus all the other time-saving advantages which enable the Friden to do more kinds of figure work without operator decisions than any other calculating machine ever developed.

To extract the square root, the operator merely sets the number on the keyboard, and touches the small key corresponding to the decimal point in the number. The square root appears in the dials almost instantaneously. If desired, the root is retained in the machine for further calculation, eliminating the need for copying the root to the keyboard, with consequent chances for error.

Booths 51-52

MONROE CALCULATING MACHINE CO.

Modern statistical calculating, with particular emphasis on quality control work, is now more than ever completely automatic on the new 8-N statistical calculator being shown for the first time at any quality control meeting. This latest statistical machine features item count from all multiplier keys with many other exclusive features which make this figuring tool a must for every statistician. Ask the man from Monroe to show you automatic squaring with a single setting of the amount—twin locks for result dials so that amounts can be accumulated in either section—automatic keyboard clearance which permits the operator to hold or clear keyboard amounts—automatic division alignment and exclusive automatic 3-factor multiplication—with lower dials split in two sections so that amounts can be accumulated in either section. See the calculator designed for statisticians.

Booth 53

BENDIX RADIO DIV.

Bendix Radio Division's quality control program has gained wide recognition throughout industry. The Bendix Radio exhibit at the Ninth Annual ASQC Convention will show—by means of charts, photographs, posters, etc.—some of the various phases of this program. The exhibit will demonstrate the effectiveness of statistical quality control in a practical application. The importance of quality education and the creation and fostering of "quality consciousness" among employees will be stressed.

Descriptive literature on Bendix Radio QC procedures will be available to visitors to the booth, and Bendix Radio representatives will be on hand to answer questions and explain the high points of the exhibit.

Advertising Your Product in

Industrial QUALITY CONTROL

Is a Real Bargain

Space	1 time	2-4 time	5-8 time	9-11 time	12 time	24 time
1 page	$190.00	170.00	155.00	145.00	140.00	135.00
⅔	155.00	140.00	122.50	112.50	110.00	107.50
½	130.00	115.00	100.00	90.00	87.50	85.00
⅓	95.00	82.50	72.50	65.00	62.50	60.00
¼	75.00	65.00	55.00	50.00	47.50	45.00
1/6	55.00	45.00	40.00	37.50	35.00	32.50

Only $15.10 a thousand to reach the men who are becoming an ever more important part of the purchasing team. . . . Quality control departments serve inspection, production, engineering, design, research departments. . . .

The quality control engineer is one man who needs to know all about

Inspection gages and measuring instruments
Production equipment and tools
Testing equipment of all types
Sub-assembly parts *and raw materials* from vendors that provide AQL certifications

For more information about a schedule in IQC contact
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Midwest: L. B. Hammond, 30 N. La Salle St., Chicago 2, Illinois, RAndolph 6-1843

Booth 54

GEORGE SHERR CO.

The George Scherr Company will have on display at their booth at the Quality Control Show, a representative part of their line of optical inspection and measuring equipment.

These instruments will include the well known Wilder micro-projector, and a new model of Leitz optical comparator which features turret mounted lenses of 10, 20 and 50X magnification with a quick-acting stage for positioning the work and surface illumination available for all magnifications. This comparator, in addition, is equipped with the well known Leitz lenses which are of the highest accuracy projecting a precise image across the entire field. In common with the Wilder micro-projector, the Leitz projector also features a horizonal work stage and a vertical light beam enabling most parts to be placed flat on the work stage without holding fixtures.

The LEITZ OPTI-COMPARITOL is a semi-optical amplifying gage for precise measurements of internal and external dimensions to 0.00005". Perhaps its most important feature is that it has only a four to one amplification mechanically. The balance is obtained optically so that on the screen it is a thousand to one. Because of the low initial mechanical amplification, the instrument is very rugged and can be used for day-in, day-out production inspection, although at the same time it is sensitive enough for the finest tool and gage work.

LEITZ UNIVERSAL TOOLMAKERS' MICROSCOPE for measurement of precision tools, gages, threads, contours, to 0.0001": and angles to 1 minute of arc. In addition, to having all of the features of the ordinary toolmaker microscope, the Leitz WM II has an intermediate image system which contains a variety of master charts, such as radii, screw threads and concentric circles. It therefore combines the ultimate precision of the toolmakers microscope, with the speed and ease of operation of a simple optical comparator.

A new model simplified toolmakers microscope will also be displayed which is of smaller capacity and very inexpensively priced for use in the smaller shops, or for large firms where precision measurements must be made right out in the shop.

LEITZ OPTICAL DIVIDING HEAD will be on display. This precision dividing head features extreme accuracy for precise spacing, as on index plates, spline gages, master gears, as well as angular measurements within 1 second of arc. It is guaranteed by the factory within 2 seconds of arc and has two quite distinctive and exclusive features:

(1) Double spherical ball bearings. These bearings contain several hundred steel balls, each of which forms its own path, permitting heavier loads to be put on the head and eliminating play. Because of this construction, its present accuracy will last considerably longer than other methods of construction.

(2) Reading the master glass scale by not one microscope tube (as is customary) but by two microscope tubes, which are brought together and seen in one common eyepiece. These are aligned within the eyepiece to eliminate even the most minute eccentricity that may be in the master glass circle.

Booth 55

WILSON MECHANICAL INSTRUMENT DIV.

The Rockwell fully automatic hardness tester, capable of testing 1000 pieces per hour, will be shown in operation at the Ninth ASQC Convention, to be held in New York, May 23-25.

Made only by Wilson Mechanical Instrument Div., American Chain & Cable Company, Inc., the Rockwell fully automatic operates basically on the same principle as the hand operated models. A minor load is applied automatically, the major load applied and removed and the indentation difference measured. Tested pieces are automatically classified in one of three categories—correct, too hard, too soft; controlled hardness limits are as close as two Rockwell numbers.

Pieces may be tested by the Rockwell fully automatic hardness tester in one of three ways: manual feed and disposal; semi-automatic—manual loading and automatic disposal; fully automatic —feeding, disposal and classification. As each piece is tested automatically, one of the three lights atop the tester will indicate the hardness classification.

Booth 60

THE L. S. STARRETT COMPANY

This year The L. S. Starrett Company of Athol, Mass. is celebrating their 75th anniversary and will have many new items to display at the Starrett Booth No. 60.

In addition, also displayed will be their complete line of dial indicators and dial gages which are manufactured to meet the highest standards of precision performance for all quality control gaging and inspection. The exhibit will include many other items closely related to quality control programs such as micrometers of all types, height gages, vernier calipers, gear tooth vernier calipers, depth gages and other precision hand measuring tools.

Those in attendance at Starrett Booth No. 60 will be Mr. F. G. Rist, Mr. R. R. Hargreaves, Mr. H. C. Sherwood and Mr. M. T. Butterworth, Factory Representatives in the greater New York area. Also Mr. R. E. Brackett, dial gage sales engineer with headquarters at the factory in Athol.

How to speed production with MAGNIFIERS

New! Illuminated 10X Pocket Magnifier

WRITE for new handbook and catalog, "Industrial Magnifiers—How to Choose and Use Them." Bausch & Lomb Optical Company, 50239 Bausch St., Rochester 2, N. Y.

Cut waste, get faster, surer inspection by fitting the magnifier to the job. This new Bausch & Lomb Illuminated Coddington floods entire viewing field with bright light *through* the lens, permitting quick, accurate, ON-THE-SPOT inspection, without need for outside lighting. Image quality is excellent! Carry this new magnifier with you always—anywhere..$7.50

Another product by Bausch & Lomb—recognized world leader in all things optical.

BAUSCH & LOMB *Magnifiers*

What's New?

ROY A. WYLIE, *Editor*

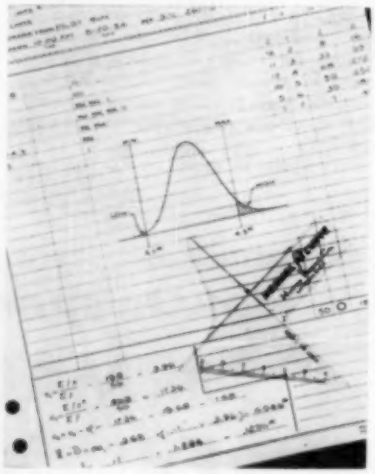
News releases describing new products and literature should be sent to:
George R. Foster, Mng. Ed.
Room 6123 Plankinton Bldg.
161 W. Wisconsin Ave.
Milwaukee 3, Wis.

Associated Research, Incorporated, 3758 West Belmont Avenue, Chicago 18, Ill., recently announced the Model 405A Hypot Junior, rated 0-5000 V.A.C. It was designed primarily for accurate, non-destructive testing of appliances and small electrical components by unskilled operators, and meets Underwriters Specifications for most of this equipment. This new model features continuously variable output voltage, current limiting high reactance transformer, a neon "breakdown" lamp to indicate arcing or corona in test circuit, a neon "leakage" lamp to indicate excessive current flow, grounds and short circuits, and an accurate (± 3%) kilovoltmeter connected directly across the output. Input is 115 V.A.C. 60 cycle. The instrument is housed in a steel case measuring 6" x 9" x 8½" and weighs 15 pounds.

★ ★ ★

DoALL 20" MONOLIGHT
lets you inspect flatness of large surface areas or groups of parts
• Checks flatness in millionths
• 30" x 30" work area
• 20 foot-candle intensity
• Mercury light
Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.
DoALL OPTICAL FLATS
ALL SIZES
Call Your DoALL Service-Store
DoALL SAW BANDS
DoALL GRANITE PLATES
Machine Tools • Cutting Tools • Measuring Instruments
Shop Supplies • In Stock
The DoALL Company, Des Plaines, Ill.

Hunter Spring Co., Lansdale, Pa., has recently redesigned their plastic "fd" device for frequency histogram analysis. The device combines a normal "fd" curve, a sigma scale and square to eliminate the repetitive computation and plotting involved in the use of frequency histograms. The "fd" device may be obtained with instructions and examples of use at $2.00 each by writing to the Quality Control Department, Hunter Spring Co., Lansdale, Pa.



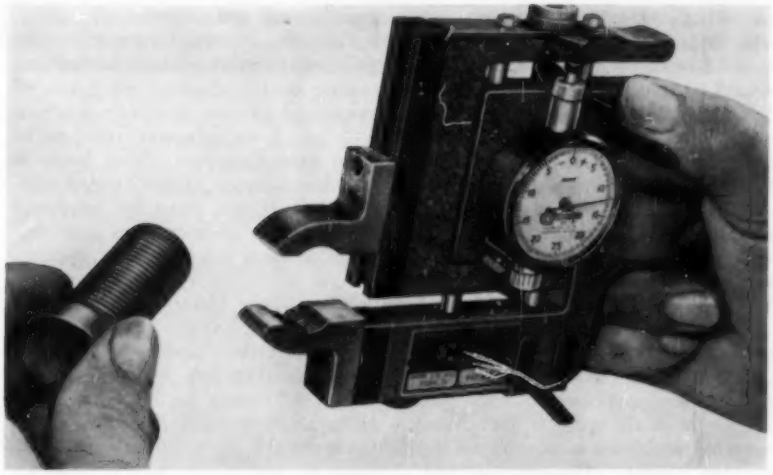
★ ★ ★

The "Color-Glance" Brinell Hardness Tester is a development of the **Steel City Testing Machines, Inc.,** 8817 Lyndon Avenue, Detroit 38, Mich. Three colored lights signal the relative Brinell hardness of the test piece. Yellow indicates too hard, green designates within range, and red shows too soft. Limits are adjustable to suit the requirements of each job. During the test cycle, one of the lights flashes on, indicating the hardness category of the part under test. When tied in with some automatic means of handling the parts on a production line basis, the new unit can be made to physically sort the work after testing, thereby making possible automatic Brinell hardness testing. Basically, the new machine is the same as the manufacturer's models KDR-6 and KDR-10 which have been used for production testing for years. A dial indicator with

adjustable electric contacts has been substituted for the standard indicator previously used, and is connected to a control panel. The same circuits which operate the lights may be used to activate solenoids, switches, relays or other electrical equipment to sort the parts into three categories. Additional material handling means must also be provided, with the machine cycle to be started by micro switches when the part to be tested is properly located on the anvil. Models with 6" or 10" throat depth and 14" maximum vertical opening are available.

★ ★ ★

A multi-purpose dial unit, named Versa-Dial, is announced by **Standard Gage Co., Inc.,** Poughkeepsie, N. Y. This versatile gage is useful for the checking of internal or external threads, grooves, shallow counterbores, narrow shoulders, etc. The user may select segments from many stock types or have special segments made. "T" slots are used to secure the segments at the desired spacing. Movement of the sliding "U" section of the gage actuates the indicator di-



rectly without intermediate linkage as in most other types. To change the unit from external to internal usage or vice versa, it is necessary merely to reverse the indicator, relocate a spring and attach or detach the lifting lever. Changes are easily made by the user. Gages may be equipped with .001", .0005" or .0001" graduations on the indicator.

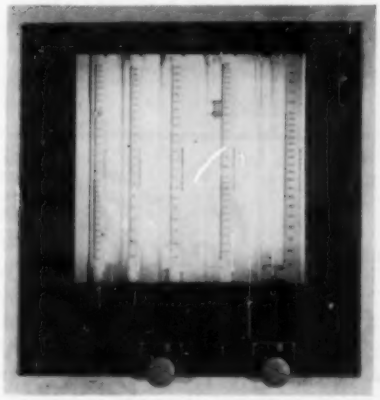
★ ★ ★

Eder Instrument Co., 2293 N. Clybourn, Chicago, Ill., is now making available the Eder Standard Flexible Inspectroscope which bends around curves and corners to inspect hidden areas of cavities. The flexible tip is turned with a wheel at the eyepiece, allowing the examination of areas which cannot be seen with a rigid instrument. Inspectroscopes are made in varying lengths and diameters to the user's specification. A new rigid model with adjustable mirror for various angles of visualization is now also available.

★ ★ ★

The Perkin-Elmer Corporation, Norwalk, Connecticut, announces the Model 118 Angle Comparator, a precision optical instrument for checking angles, surface flatness and parallelism between two surfaces, independent of environmental conditions, physical pressure, or the "feel" of the inspector. Collimated (parallel) light is reflected off the surface to be checked, back through a beam splitter where it is imaged on a reticle. If the surface being checked deviates from the standard for which the Angle Comparator has been set, the reflected image is viewed displaced from the normal or standard. The displacement can be directly measured on the graduated reticle as the angular departure from the standard. One division of the reticle scale equals one minute of angle. The whole reticle equals 80 minutes. Angles can be estimated to 15 seconds.

★ ★ ★



Commercial Research Laboratories, 20 Bartlett Avenue, Detroit 3, Mich., announce the Cox Type 8 Single-Stage Flowmeter, now available with a maximum capacity of 50,000 pounds per hour. It is claimed to be the most accurate single-stage, variable area industrial flowmeter now made. Bulletin No. 1048 describes the special features of interest to the automotive, aircraft, chemical and petroleum industries. Also available as special equipment on single- and multiple-stage flowmeters is a new explosion-proof fluorescent direct lighting system, providing direct illumination of the metering tubes and the plastic, translucent scales in the flowmeter. One or two 20-watt fluorescent lamps are sealed into a special housing and assembled into a steel shell which surrounds the entire explosion-proof lighting unit.

★ ★ ★

A new ultrasonic instrument, the Type RA Signalling and Recording Attachment for the Sperry Reflectoscope, has been announced by **Sperry Products Inc.**, Danbury, Conn. The instrument utilizes echoes from defects to set off visual or aural alarms and will accommodate pen recorders making permanent records. With this attachment, it is no longer necessary for the operator to watch continuously the cathode ray screen to find or to interpret indications of dedects, because the instrument warns the operator when specified defects are located. The unit attaches to the Reflectoscope easily and makes more effective the use of the device in quality control operations as well as inspection of machinery and components for defects during maintenance.

★ ★ ★

Montgomery Tool Sales, Box 1241 Church Street Post Office, New York 7, N. Y., are introducing Thread

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with NEW Bausch & Lomb
OPTICAL COMPARATOR
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Finest, Lowest Priced, Quality Unit of its Kind
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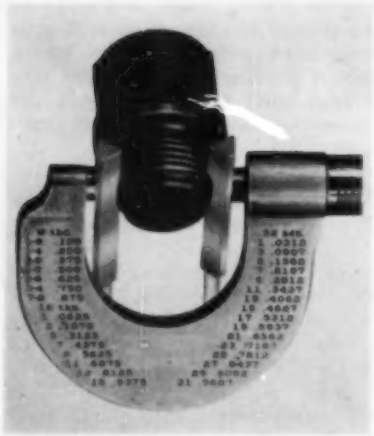

Triangle Gauges, an improved thread measuring tool for machinists. Thread Triangle Gauges are two hardened and ground triangular shaped bars. They are set over and under the threaded part and a micrometer reading is taken over the triangles. This reading is checked against the sum of the nominal O.D. of the thread and the chart factor. Checking of all 60 degree threads from 4 to 56 pitch, standard and non-standard, is possible with accuracy as good as with three wires.

★ ★ ★

New Literature

The following new literature is available by writing to the company listed. Please mention *Industrial Quality Control* when you contact any of the companies mentioned in the "What's New?" department.

Gries Industries, Inc., Testing Machines Div., Beechwood Avenue at Second Street, New Rochelle 6, N. Y., has published a bulletin on the new Wolpert-Gries Machine for Standard Rockwell Hardness Tests. This bulletin describes the various uses and tests that can be performed, as well as the unusual features of the hardness test unit.

Federal Products Corp., 1144 Eddy St., Providence 1, R. I., have issued a booklet entitled "A Management Blind Spot." This booklet points out often hidden and neglected opportunities to cut costs and increase profits. It deals with many unappreciated problems of undersize and oversize pieces; of scrap, salvage, and rework. It explains how to solve this problem of cutting down expensive secondary operations by keeping production under control and quality standards up to specifications.

Spitfire Tool Company, 2931 N. Pulaski Rd., Chicago 41, Ill., has issued a new bulletin covering their Precision Roller Lapping Machine "12." The bulletin includes complete specifications and other vital data on Roller Lapping in general and the Spitfire "12" in particular.

George Scherr Company, Inc., 200 Lafayette St., New York 12, N. Y., is making available a 100-page book describing all models of the Mahr Precision Gear Tester, which gives complete information on this line of gear testing instruments. The book, in addition, gives information regarding the most modern methods of testing and inspecting all types of gears and various gear tables which will be of considerable interest to gear manufacturers. The book is free but because of the limited supply, distribution must be restricted to only key personnel in gear inspection and gear cutting departments.

Jansson Gage Company, 13550 Auburn Ave., Detroit 23, Mich., has announced their move to new and larger quarters and at the same time issued a 19-page catalog which presents the extended line of Jansson Gage block sets, sine bars, trisquares, and accessory sets.

Minnesota Rubber and Gasket Company, 3630 Wooddale Ave., Minneapolis 16, Minn., have printed a second issue of their Engineering Handbook. This 82-page manual is a comprehensive technical publication on rubber seals and gaskets. Industry standards, specifications and testing in the rubber field together with general information, uses, charts and specifications for the firm's four types of industrial seals are included. Other information includes a description of customer molding operations, use of leather back-up washers, silicone rubber and charts and tables used in machinery design. A final section incorporates a comprehensive glossary of rubber terms.

Local Section News

"... BUT NOT FORGOTTEN"

ALLENTOWN -BETHLEHEM This section was quite disappointed on Jan. 13 when word was received that bad weather forced Dorian Shainan to cancel his scheduled appearance. Miss Bonnie Small, however, substituted magnificently and created renewed interest for the meeting.

BUFFALO Approximately 60 members and guests made a tour of the Du Pont "Yerkes" plant and were shown an actual first hand application of statistics in action. This was one of our better meetings and was preceded by a very good dinner.

CENTRAL ILLINOIS Approximately 75 persons attended the section meeting Feb. 5, held at the University of Illinois. In addition to section members, the group comprised participants in the University's Eighth Annual Short Course on Quality Control by Statistical Methods, and members of the University of Illinois faculty and staff. G. H. Golub, Research Assistant, University of Illinois Digital Computor Laboratory, discussed the use of the Illiac in solving industrial problems in statistics. Warren Jones, Management Controls, DesPlaines, Ill. presented a talk "Whither Quality Control?" in which pitfalls encountered by QC engineers in the past were cited and possible means of circumventing them were suggested. Statistical techniques used in quality steel manufacture was illustrated with the use of slides by Leon H. Nelson, Crucible Steel Corp., Pittsburgh, Pa.

One of the highlights of the meeting was the presentation of certificates to the following founders and charter members of the Central Illinois Section:

Carl Budelier, John Deere Co.
Frank T. Pettit, Caterpillar Tractor Co.
E. Russel Meyer, Eureka-Williams Co.
Prof. John A. Henry, University of Illinois
Leon H. Nelson, Crucible Steel Corp.
Ura H. Conrad, Caterpillar Tractor Co.

Shown above is A. H. Benscoter, chairman of the Central Illinois Section, presenting the certificate (inset) to founding members C. R. Budelier, L. H. Nelson, J. A. Henry and E. R. Meyer.

CHICAGO On Jan. 12, an elementary educational meeting was held at the University of Illinois (Navy Pier). This was the first training session devoted to process controls.

The third regular meeting of this section was held Jan. 19, at the Furniture Club of America, Chicago, Ill. The afternoon speaker was E. L. Fay, Deere and Company, who presented a talk on "Introducing Quality Control." Dr. W. J. Youden began the evening meeting by presenting diplomas to members completing the advanced educational program. Dr. Youden then spoke on "Statistical Techniques Light the Way."

CINCINNATI The Cincinnati Section held its Fourth (and best attended) Annual Quality Control Conference on Jan. 29. The speakers and panelists were George E. Fouch, General Electric Co., Cincinnati; Dr. Edwin G. Olds, Carnegie Tech, Pittsburgh; Dorian Shainin, Rath & Strong, Boston; Dr. Joseph M. Juran, Consulting Management Engineer, Tuckahoe, N. Y.; L. R. Zimov, Avco; W. W. Carter, Formica, and Enoch While, Allis-Chalmers, Cincinnati.

The Conference theme was "Organizing for Quality." There were six major exhibitors; 328 people registered for the Conference, and most showed up in spite of a headline, traffic-stopping snowstorm. As pre-Conference publicity, Leon Bass and Jack Gantt of General Electric presented a layman's description of quality control on a television program.

Proceedings of the Conference may be obtained for one dollar a copy by writing to H. D. Birch, Building 500, General Electric Co., Cincinnati 15, Ohio (Dr. Juran's panel discussion was tape recorded.)

CLEVELAND The regular monthly meeting of the Cleveland Section on Jan. 7 was highlighted by a talk on a very interesting subject, "Why Statistical Methods" by Leon Bass, QC engineer, General Electric Jet Engine Div., Cincinnati, Ohio.

DAYTON The fifth technical meeting for the Dayton Section was held Jan. 20 and consisted of a plant tour of the new Kettering Plant of Delco Products, GMC. This plant produces mostly large motors and generators. Several QC techniques were observed on this tour. Following the tour the group assembled at the Delco Lodge for a discussion and review of the methods and procedures used and a very interesting talk by Leo Nartker of Delco Products on some specific examples in the analysis and control of quality on motors and generators.

DENVER The basic concepts of significance testing as used in making management decisions was discussed by Gayle McElrath in his address to the Denver Section at its January meeting. He dealt with the fundamentals of distribution and the ideas which are germane to determining a significant difference. As a tool for management, the discussion of types of errors, the risks involved in making decisions, and the thinking behind a significance test, will prove highly useful and stimulating to those who are required to choose one of several courses of action. Those who may cringe when faced with theoretical mathematics were pleased to hear Prof. McElrath bridge the gap between the theoretical and practical.

ERIE On Jan. 12 Charles Bick, North American Films Inc., spoke on "The Sound Motion Picture As A Problem Solver." As an illustration he projected a typical North American movie—"The A B C's of Flashovers." which was recently produced for the GE Locomotive Division. The uses of color, background music, slow motion, animation, effective sound, and narration were well illustrated by the film.

EVANSVILLE -OWENSBORO North American Aviation Corp.'s Ervin F. Taylor very ably presented "Discovery Sampling" to the section on Jan. 18. It's a coming thing. Contact "Erv" at the Columbus, Ohio plant. James R. Crawford at North American's West Coast plant can be talked into giving it also.

GEORGIA The Atlanta Group of the Georgia Section was organized on Jan. 25 in Room 1101, Hurt Bldg. as a new working part of the section. The officers elected at this meeting are:

Leader—Donald S. Holmes, 2694 Belle Isle Circle, NE Atlanta, Ga.

Asst. Leader—Ralph H. Coon, 855 Holly Drive, Decatur, Ga.

Sect.-Treas.—E. G. Field, 670 Park Drive, NE, Atlanta, Ga.

Although the first meeting was primarily for discussion, arrangement, and organization, a short talk was given on "Cost Saving Through Quality Control."

Meetings are to be held on the last Tuesday of each month, except in the summer.

HUNTSVILLE The Huntsville Section had a joint meeting with the Huntsville Section of the American Chemical Society at the Russell Erskin Hotel, on Jan. 20. The speaker for the meeting was Dr. Robert James Monroe, North Carolina State College,

Raleigh, N. C. The subject of Dr. Monroe's speech was "Statistics in Laboratory Planning." Dr. Monroe presented some simple statistical principles of sampling and estimation. These principles were discussed in the form of actual examples and applications.

INDIANAPOLIS The Jan. 18 afternoon meeting began with a panel discussion led by Carl Hoover, Perfect Circle Corp. The evening meeting was addressed by W. H. McGlade, Adams Div., LeTourneau-Westinghouse Corp. He told the group how the Adams Division has been able to reduce the inspection force considerably and raise the outgoing quality level through the use of SQC techniques.

INDIANAPOLIS
Columbus Sub-Section On Jan. 13 Prof. Charles Hicks, Purdue University, addressed the regular monthly meeting. The subject of his talk was "Statistical Thinking for the Engineer."

INDIANAPOLIS
Lafayette Sub-Section On Jan. 19 the regular monthly meeting was addressed by Dr. I. W. Burr, Purdue University. His subject was "A Simple Summary of Quality Control Methods."

INDIANAPOLIS
Richmond Sub-Section A dinner meeting was held on Jan. 26. This was "Management Night" and all members were invited to bring their "bosses." The speaker was C. V. Garrett, Allison Div., GMC. His topic was "Is SQC Profitable?"

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KANSAS CITY The January meeting was a dinner meeting held at the Blue Hills restaurant. The members and guests viewed the Ford Motor Company's training film, "Vendor Certification" and a film and demonstration on the application and optical comparators. The accuracy of optical system measurement, which was the feature of the film, was further demonstrated by optical measuring instruments which were displayed.

LINCOLN The January meeting consisted of a tour of the Omaha World Herald Printing Bldg. The speaker for the evening was Father Davillan, Creighton University. His topic was "Facts and How To Get Them."

LOS ANGELES "Feedback Approach to Reliability" was the theme used by David A. Hill, Hughes Aircraft Corp., in assembling an interesting and provocative program for the January meeting of the Los Angeles Section. Assisting him was G. L. Coates, H. D. Voegtlen and J. D. Stevenson all of Hughes Aircraft. They covered feedback from designer, maker, user, and maintainer and back to each of these. Information thus received and disseminated has done a great deal to improve quality and allow savings in production.

LOUISVILLE At the January meeting of the Louisville Section E. L. Fay, Deere & Co., addressed the group with "Using Tools of QC." His talk was most interesting and informative to the well attended meeting.

MICHIGAN This section's dinner meeting and dance was very well attended and all present were "Thoroughly" entertained by the section chairman, Herman Bogin. This type of social activity gave the wives of the section members a chance to see what their husbands do at work and also where they go on their "meeting" evenings.

MILWAUKEE A very successful "Ladies Night" was held Jan. 17 at Marquette University. The highlight of the meeting was an address by Miss Bonnie Small on "The Inside Story of Quality Control." Miss Small gave our wives an excellent resume of a quality control engineers work, and simplified it to the extent that all could understand the various phases of quality control.

MINNESOTA Irving W. Burr, Purdue University, was the speaker at the regular meeting of the Minnesota Section on Jan. 31. His subject was "Short Runs" which proved exceptionally educational and interesting.

MONTREAL On Jan. 19 the guest speaker at the monthly meeting of the Montreal Section was D. H. W. Allen, Steel Company of Canada, Hamilton, Ont. His topic "The Use of Statistical Methods in the Metals Industry," was based on a recent survey made in the United States and Canada.

MUNCIE A dinner meeting was held in January. W. E. Spencer spoke on the subject "The Application of SQC at the Allison Div. of General Motors." His talk was illustrated with the use of slides.

NEW HAVEN On Jan. 25 a joint dinner meeting was held with the Society for Advancement of Management. Charles W. Carter, Rath & Strong, was the guest speaker. The previously scheduled speaker, W. M. Biklen, American Safety Razor Co., was unable to appear. The meeting was well attended by members and guests of both societies.

RICHMOND Dr. A. J. Duncan presented a thought-provoking paper on the "Economical Design of $\bar{X}$ Control Charts" at the January meeting. An original formula was discussed which takes into account many factors of cost and risk. By means of the formula, the optimum sample size and sampling interval are found for use with a particular control chart design.

ST. LOUIS The January meeting of the St. Louis Section was honored by the presence of Dr. I. W. Burr who gave an inspiring talk on the subject, "An Engineer Continues His Learning of Statistics in QC." For a regular meeting this was the largest attendance ever experienced in St. Louis. Maybe it is significant that for the first time in a few years the St. Louis publicity group was able to "crack the St. Louis newspaper" which gave a fine write-up on Dr. Burr and his proposed talk.

SALT LAKE CITY At a dinner meeting on Jan. 13 Henry F. Myers, Columbia Geneva Steel Div., U. S. Steel, gave a very interesting illustrated talk on "Application of Statistical Analysis for Quality Control in Steel Mills."

SEATTLE The problem clinic held Jan. 11 was a rousing success. Led by vice-chairman and program director Eugene Goddess, members and guests gave suggestions for the solution of problems facing the frozen food and plastics industries. Members submitting problems appreciated the assistance of practical quality control problems.

SOUTH BEND-MISHAWAKA Our January meeting featured a panel discussion led by D. E. Van Hine of the Northeastern Indiana Section on introducing statistical quality control to production supervision. This was followed by a question and answer forum. Other panel members were L. R. Welty, moderator, Robert Fitzgibbons, James McFann, and J. F. Gyoles.

On Jan. 18, we began a 15-week basic course in SQC using the University of Iowa Section training program. As a new section we were somewhat hesitant about tackling the program and anticipated an enrollment of about 15 persons. To our surprise and gratification, we attracted 44 people, all section members, which necessitated two classes instead of the original one. The educational committee chairman is Prof. C. Robert Egry, College of Engineering, Notre Dame University.

SOUTHERN CONNECTICUT The first meeting of the Southern Connecticut Section for 1955 was held in the Stratfield Hotel, Bridgeport, Conn., on Jan. 12. Principal speakers were Clifford C. Marshall and William J. Loeffler of the Cincinnati Milling Machine Co., Cincinnati. Marshall and Loeffler, who have served their company in various capacities chose "Selling Quality" for their topic. The meeting drew particular interest among machine tool builders and subcontractors in the Southern Connecticut area. Following the talk a lengthy question and answer session took place which even exceeded the regular meeting time.

SOUTHERN TIER The Southern Tier Section met on Jan. 4 at the Vestal American Legion Clubhouse to hear J. Huff, Optical Gaging Products Co., give a very fine and interesting talk on "Inspection By Optical Projection Methods." E. C. Polidor was unable to appear as the scheduled speaker.

The Southern Tier Section and the Binghamton Chapter of ASTE held a joint meeting on Feb. 1 at the Elk's Roof Garden, Binghamton, N. Y. C. G. Schelley, managing director of the Wilkie Foundation, Des Plaines, Ill., gave an explanation of various articles contained in an exhibit entitled "Civilization Through Tools." The highly interesting exhibit was sponsored by the DoALL Co. of Des Plaines. A total of 166 people attended a dinner and the lecture.

STATE UNIVERSITY OF IOWA The mid-year Section Meeting was a one-day conference held at the Savery Hotel, Des Moines, on Jan. 21. In addition to the usual problems clinic, three outstanding speakers of national stature were featured. Guy G. Parkin, Minnesota Mining and Manufacturing Co., presented a paper on "Sales Forecasting, Inventory Control, Scheduling, and Mathematical Programming of Factory Production and Warehouse Distribution;" Edward Varnum, Barber-Colman Co., spoke on the subject of "Significance Tests;" and Dr. Lloyd A. Knowler, State University of Iowa, was clean-up hitter with a talk on "Acceptance Sampling by Variables."

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SYRACUSE A symposium on the use of punched card methods in quality control was held on Jan. 25. Moderator of the symposium was George M. Armour, GE, Syracuse, N. Y. George A. Endrich, also of GE, spoke on "Material and Process Control." Irvin C. Kepner, IBM, Endicott, N. Y., spoke on "Scrap and Rework Analysis." Richard R. Landers, GE, spoke on "A Mechanical System of Reporting and Processing Field Performance Data."

TENNESSEE
Memphis Sub-Section The Feb. 2 meeting took place at the International Harvester Co., Memphis. The speaker was James M. Barabee, International Harvester Co. His talk, "QC in Heavy Industry," covered vendor certification, the use of SQC in receiving, inspection, and other applications in process control. The talk was supplemented with slides. Following the talk, there was a conducted tour of the plant, arranged by Douglass Ferris, QC director of the Memphis plant.

WASHINGTON On Jan. 18 the Washington Section held a joint meeting with the National Association of Purchasing Agents. The theme of the meeting was "Cooperation Between the Sales, Purchasing and QC Departments Leads to Better Products at Less Cost." Moderator of the panel discussion was H. N. Arbutnot, Allegheny-Ludlum Steel Co. The speakers were George E. Goodrich, Westinghouse; Horace Shaw, Melpar; and Philip Whitaker, Melpar. Booklets on SQC supplied by Monroe, Friden, Monsanto and Sheffield were distributed at the meeting.

WESTERN MASSACHUSETTS The college credit course in Elementary Industrial Statistics being co-sponsored by this section and the University of Massachusetts Extension had its last session on Jan. 15. Of 63 people starting the course 60 completed it.

WICHITA The Wichita Section met for the regular monthly dinner meeting at the Pastime Gardens, Jan. 4. Ernie Fay, Deere and Co., Moline, Ill., spoke on "Using the Tools of Quality Control."

WINDSOR Clarence Burdick, Houdaille-Hershey Corp., Detroit, addressed a group of 57 persons representing 19 industries in the Windsor area. His topic—"The Foreman's Place in a Quality Control Program"—was enthusiastically received. A question and answer period followed the talk.

WORCESTER Richard Harris, Norton Co., Worcester, was substitute speaker for Wm. Perks of the same company, and presented Perks' scheduled speech at the monthly dinner meeting. The talk, "Budgeting Rejections," covered the use of scrap and rework costs by the controller's office to place regular monthly budgeting figures on each department. The savings derived were substantial.

YOUNGSTOWN Arthur P. Woods, Jr. spoke before the Youngstown group on Jan. 13 at the V.F.W. Hall. He outlined some statistical methods used in steel plant operations. Several out of town guests came to hear his talk in spite of the heaviest snow storm of the season.

"... CAST THEIR SHADOWS BEFORE"

ALLENTOWN -BETHLEHEM Allin P. Deacon, Cockshutt Plow Co., Brantford, Ont., will speak to the Allentown-Bethlehem Section Apr. 14 on "Foundry Quality Control for Short Runs" at Hotel Traylor, in Allentown.

CHICAGO The fourth regular meeting will be held on Mar. 23 at the Furniture Club of America. The meeting will start at 4:00 pm, dinner will be served at 6:15 pm and the evening session will start at 7:15 pm. The subject will be "Coordinating the Quality Control Program on an Interdepartmental and Interplant Basis."

CLEVELAND Great plans are in the making for "Quality Control Week" in Cleveland. A TV showing of "Quality Control at Work" on Station WNBK, Channel (3), at 12:30 p.m. on Sunday, March 27, will open "Quality Control Week." An all day conference on Tuesday, Mar. 29, will bring speakers and interested parties from all over the country. This will be followed by the regular monthly meeting of the Cleveland Section on Apr. 1. Quality Control Week in Cleveland is being sponsored and arranged by the Cleveland Section.

DENVER "Tests of Significance in Industrial Processing" will be the theme of the March meeting. Guy G. Parkin, Director of Industrial Statistical Control, Minnesota Mining and Manufacturing Co., will continue our education in significance testing.

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SEATTLE – MARCH 18 & 19, 1955

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INDIANAPOLIS On Apr. 19 the regular monthly meeting day will open at 4:30 pm in the World War Memorial Bldg. with a chalk talk presented by Prof. Charles Hicks, Purdue University. The evening meeting, starting at 7:30 pm will be addressed by Edgar King, Eli Lilly and Co. His subject will be "Practical Problems in Experimental Design." This meeting will be held at the Indiana State Board of Health Bldg. in the Rice Memorial Auditorium.

KANSAS CITY On the night of Apr. 13 members and their wives will be the guests of the Muehlbach Brewery on a plant tour. Following refreshments and the plant tour a business meeting will feature the nomination of officers for the coming year.

MICHIGAN The monthly meeting for March will be quite unusual and promises to be an extremely interesting application of statistics to industry. The industry under discussion will be the commercial drug industry. The speaker will be Dr. C. I. Bliss who is affiliated with the Connecticut Agricultural Experiment Station and his topic will be "Drug Potency in Man."

MILWAUKEE The Milwaukee Section will have their Apr. 18 meeting at Marquette University, and the guest speaker will be Warren R. Purcell, Rath and Strong Inc., Boston, Mass. His subject will be "Quality Pre-Control—A New Tool for Long and Short Runs." This subject will be of interest to all, and we are expecting a large turnout at this meeting.

MINNESOTA On Mar. 17 at the regular monthly meeting of the Minnesota Section, Dr. Russell Ackoff, Case Institute of Technology, Cleveland, will be the principal speaker. The topic of his talk will be "Case Studies in Operations Research."

MONTREAL The guest speaker at the Mar. 23 meeting of the Montreal Section will be Miss Bonnie Small, Western Electric Co., Allentown, Pa. The meeting will be held in the Chemistry Bldg., McGill University; starting time 8:15 pm. The topic of Miss Small's talk will be "Control Chart Analysis of Engineering Experiments."

NEW HAVEN On Apr. 12 for our eighth meeting of the season, we will have F. E. Dunn, of Ralph E. Burt Assoc., as our guest speaker. He will speak on "Selling Quality to the Operator." A dinner will be served prior to the meeting, at the Colonial House, Hamden, Conn.

RICHMOND W. L. Gore, E. I. du Pont de Nemours, is again scheduled to speak to the Richmond Section on Mar. 22. His talk of Sept. 10 before a joint meeting of ASQC and ACS was cancelled because of a hurricane. After a social hour and supper he will talk on "Design and Analysis of Experiments."

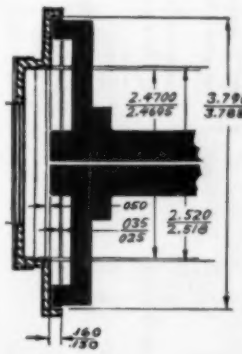
ST. LOUIS On Apr. 15 Guy Parkin, Minnesota Mining and Manufacturing Co., St. Paul, will speak before the St. Louis Section. He will discuss statistical techniques for forecasting sales, and in his talk will show the relationship with purchasing, scheduling, production, shipping and inventory. This promises to be an excellent evening for all who attend. There will be the usual social hour prior to dinner, and during this time one of the movies on QC procedures will be shown.

SALT LAKE CITY Winston Dalleck, United Air Lines, will address a dinner meeting of this section on Apr. 14. The subject of his talk will be "Application of Quality Control in Air Line Accounting."

SEATTLE On Apr. 12 at the Benjamin Franklin Hotel, Melvin F. Pugh, Pacific Telephone and Telegraph Co., will speak on "Quality Control as Applied to Operator Performance." This meeting will also see the election of officers for the fiscal year beginning July 1. After the program the Seattle Section will not only elect officers for next year but will hold a post-mortem on the Joint Second Western Regional and Third Pacific Northwest QC Conference.

SOUTH BEND-MISHAWAKA The sudden passing of E. L. Fay, who was to have been our guest at the Management meeting on Apr. 21, caused deep regret to our section as we regarded Ernie to be top man in this field. Warren Jones, Management Controls, Des Plaines, Ill., has graciously consented to address this meeting. The meeting will feature the Ford Motor Co. film on vendor certification and will be narrated by Andy Thomas, Bendix Products. This meeting will be held as usual in the Engineering Auditorium of Notre Dame University.

SOUTHERN CONNECTICUT The section will meet in the Strat-



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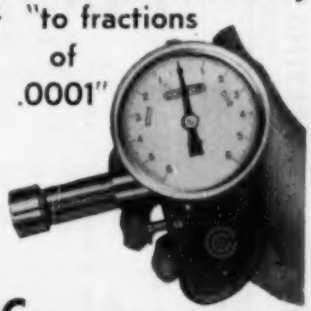

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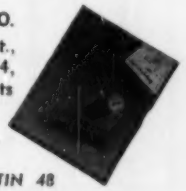

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CALENDAR OF MEETINGS -- MARCH 20, 1955 -- APRIL 19, 1955

*Indicates meeting dates in March

SECTION	DATE	MEETING PLACE	TIME	SUBJECT	SPEAKER
Albuquerque	6	———	———	Problems in the Use of Quality Control	Panel Discussion
Allentown-Bethlehem	14	Hotel Traylor, Allentown, Pa.		Foundry Quality Control for Short Runs	A. P. Deacon, Cockshutt Farm Equip., Ltd.
Boston	15			Civilization Through Tools	The Wilkie Foundation & DoALL Co.
Buffalo	28*	Univ. of Buffalo		Problem Clinic	Panel
Chicago	23*	Furniture Club of America	4:00 p.m.	Coordinating the QC Program on an Interdepartmental and Interplant Basis	———
Cleveland	27*	———	12:30 p.m.	Opening of "Quality Control Week"	TV Show—Station WNBK
Columbus	2		———	Quality Control Clinic and Management Dinner Meeting	———
Delaware	31*	———		Who Is Responsible for Quality?	L. A. Seder, Quality Control Consultant
Denver	—	———	———	Tests of Significance in Industrial Processing	G. G. Parkin, Minnesota Mining & Mfg. Co.
Evansville-Owensboro	19	———	7:15 p.m.	Graduation Night	A. Bender, Delco-Remy Div., GMC
Harrisburg	6	York, Pa.	———	Fundamentals of Quality Control	A. Bender, Delco-Remy Div., GMC
Indianapolis	19	Indiana State Board of Health Bldg.	7:30 p.m.	Practical Problems in Experimental Design	Edgar King, Eli Lilly & Co.
Kansas City	13	Muehlbach Brewery	———	Plant Tour	———
Lansdale	18	RCA Camden Division	———	Joint Meeting With the Philadelphia Section	Plant Tour
Los Angeles	13	———	———	Reliability of Guided Missiles	E. P. Wheaton, Douglas Aircraft
Louisville	—	———	———	QC Clinic	———
Michigan	—	Univ. of Michigan	———	Drug Potency in Man	Dr. C. I. Bliss, Conn. Agricultural Exp.
	15	Univ. of Michigan	———	Statistical Quality Control in the Office	W. F. Buhl, The B. F. Goodrich Co.
Mid-Hudson	5	———	———	Process Control in the Paper Industry	Dr. C. E. Noble, Kimberly-Clark Corp.
Milwaukee	21*	Marquette University	6:30 p.m.	What's the Difference?	Prof. M. E. Wescott, Rutgers University
	18	Marquette University	7:30 p.m.	Quality Pre-Control—A New Tool for Long & Short Runs	W. R. Purcell, Rath & Strong, Inc.
Minnesota	14	———	———	Quality Control Applications	Donald Greb, Perfex Corp.
Montreal	23*	McGill Univ., Chem. Bldg.	8:15 p.m.	Control Chart Analysis of Engineering Experiments	Miss Bonnie Small, Western Electric Co.
New Haven	12	Colonial House, Hamden, Conn.	———	Selling Quality to Operator	F. E. Dunn, R. E. Burt Associates
NE Indiana	14	———	———	Quality Control Applied to Sales Forecasting	William Courtright, Argus Cameras, Inc.
Philadelphia	15	RCA—Front & Cooper Sts., Camden	2:00 p.m.	Plant Visitation	T. A. Smith, RCA
Richmond	22*	Holloway House	6:15 p.m.	Design and Analysis of Experiments	W. L. Gore, E. I. du Pont de Nemours
St. Louis	15	———	8:00 p.m.	Statistical Techniques For Forecasting Sales	G. G. Parkin, Minnesota Mining & Mfg. Co.
Salt Lake City	14	———	———	Use of Quality Control in Airline Accounting	Winston Dalleck, United Air Lines
San Diego	11	Solar Auditorium	7:30 p.m.	Movie—"The Prior Claim"	E. G. Smith, Chairman
Seattle	12	Benjamin Franklin Hotel	———	Quality Control As Applied to Operator Performance	M. E. Pugh, Pacific Telephone & Telegraph
South Bend-Mishawaka	21	Eng. Aud., Notre Dame Univ.	———	Ford Motor Co. Films	Warren Jones, Management Controls
Southern Connecticut	13	Stratfield Hotel, Bridgeport	———	Foundry Quality Control for Short Runs	A. P. Deacon, Cockshutt Farm Equip., Ltd.
Southern Tier	5	Vestal American Legion Clubhouse	———	Electronic Computing Equipment—The QC Tool	W. E. Andrus, Chairman
Syracuse	29*	———	———	Don't Bet Till You Know the Odds	Burr Stanton, General Electric Co.
Trenton	1	Jenkintown, Pa	———	Plant Visit: Standard Pressed Steel Co.	———
Washington	23*	———	———	Local Talent Night	———
W. Massachusetts	12	Mt. Laurel Restaurant	———	Quality Pre-Control	C. W. Carter, Rath and Strong, Inc.
Wichita	5	———	———	Johns-Manville Film and Discussion	Simon Collier, Johns-Manville Corp.
Winnebago	4	Appleton, Wis.	———	Johns-Manville Film and Discussion	Simon Collier, Johns-Manville Corp.
Youngstown	14	Mural Room, Youngstown	6:30 p.m.	Correlation	Prof. Max Astrachan, USAF Institute of Tech.

field Hotel, Bridgeport, Conn., to hear R. E. Wagenhals, Timken Roller Bearing Co., who will speak at the section's March meeting on the subject, "Quality Control at Timken." A social hour will take place at 6:15 pm; dinner at 6:45 pm; the meeting at 8:00 pm. The various quality control applications at Timken will be explained by the speaker and the machine capability studies promise to be of great interest to the majority attending because precision machines for quality production are used by the many local manufacturers.

SOUTHERN TIER Wm. E. Andrus, chairman, will address the section members at a dinner meeting which will be held Apr. 5 at the Vestal American Legion Clubhouse. His subject will be "Electronic Computing Equipment—The Quality Control Tool." Since he is actively engaged with problems in the computing laboratory of IBM, his presentation should be of extreme interest to all members.

WASHINGTON Local talent night will be held on Mar. 23. During the winter the section sponsored a contest for people who had never had papers published, in an attempt to encourage new talent. Contest winners will present their papers at the Mar. 23 meeting and the section plans to submit them to the Editorial Board to be considered for publication in IQC.

WESTERN MASSACHUSETTS On Apr. 12, 1955, C. W. Carter, Rath and Strong, will speak on "Quality Pre-control." The meeting place will be the Mt. Laurel Restaurant in Thompsonville, Conn., and the emphasis of the meeting will be on textiles.

WICHITA The April meeting of Wichita Section will be held the evening of Apr. 5, and our program chairman has continued his avowed purpose of bringing to Wichita another national QC figure in Mr. Simon Collier, Johns-Manville Corp., N. Y. He will present a film and commentaries on "Johns-Manville Quality Control Operation."

WORCESTER Dr. A. V. Feigenbaum, General Electric Co., Schenectady, N. Y., will address the Mar. 17 meeting on "Quality Control as a Management Method."

YOUNGSTOWN On Apr. 14 Prof. Max Astrachan, USAF Institute, Dayton, will speak to the Youngstown Section on "Correlation." The meeting will be preceded by the regular monthly dinner meeting to be held at 6:30 pm in the Mural Room, 225 W. Boardman St., Youngstown.

"AS YE SOW . . ."

LOUISVILLE The second QC Clinic of the Louisville Section will be held in March. The program and exhibitions line up for this clinic should make it an even bigger success than the first one.

PURDUE UNIVERSITY The ninth annual advanced course in "Quality Control by Statistical Methods" will be held June 20-28. This course is intended for those who have already had an elementary course and who wish to go on to more advanced techniques.

The topics will include significance tests and estimation, acceptance sampling by variables, sequential analysis, linear and multiple correlation, analysis of variance, tolerances of mating parts, and the chi-square test. This course is under the direction of Prof. Irving W. Burr and will include on the instructional staff Profs. Mason E. Wescott, Edwin G. Olds, Lloyd A. Knowler, Cecil C. Craig and Charles R. Hicks.

Further information on the course may be obtained from Prof. Burr at Purdue University, Lafayette, Ind.

11TH CHEMICAL INDUSTRY SQC COURSE An eight-day intensive training course in quality control for the chemical industries will be offered by the Rochester Institute of Technology at Rochester, N. Y., June 7-15, 1955. In contrast to courses which usually emphasize mechanical and metal cutting operations, the content of this program is devoted exclusively to the control problems of the chemical and allied process industries.

The course is particularly designed for those responsible for controlling product either in the analytical laboratory or directly in the manufacturing process. Emphasis will be placed on the practical application of quality control in these areas. Instruction will cover basic statistical control and sampling methods as well as many of the advanced techniques such as design of experiments, correlation and analysis of variance. Companies engaged in research and development work, or those having a continuous or batch-lot type of production process will find the program of particular value.

The tuition of $100 per person includes books and supplies. Room accommodations will be available at the Hotel Rochester. Further inquiries should be addressed to the course coordinator, Robert D. Pease, Evening Division, Rochester Institute of Technology, Rochester, N. Y.

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ST. LOUIS The St. Louis Section is planning for a one-day clinic next Fall and the groundwork is being laid now with Kort Pfabe, Carter Carburetor Corp., acting as the chairman for this clinic.

"FOR MANY ARE CALLED, BUT FEW ARE . . ."

BUFFALO Will Irvine has resigned as our Secretary-Treasurer and Bob Stohr will take over the balance of his term.

CINCINNATI Richard M. Race, quality control manager, U. S. Playing Card Co., was appointed vice chairman to succeed the late Henry J. Schwartz, Jr.

SALT LAKE CITY Leon K. Nelson, Hill Air Force Base, takes over the duties of Secretary from William A. Hoagland, Vice Chairman, who had assumed the duties after Robert A. Cromar, former Secretary, was transferred to the Denver operations of United Air Lines.

YOUNGSTOWN V. P. Ahier, treasurer of the Youngstown Section since its formation, had to resign his office due to ill health. W. J. Cain, superintendent of quality control at Republic Steel Corp. will assume his duties for the remainder of the year.

MEMBERSHIP CORNER

The American Society for Quality Control depends for its support upon the enthusiasm of its members. The best measure for the National Society or any local section as to whether this enthusiasm is continuing lies in the statistics on membership.

Our Milwaukee section uses two presentations of these statistics each month to determine exactly how well the local section officers are doing the job of maintaining enthusiasm of the members.

(a) Status on renewals and new members

(b) Analysis of meeting attendance.

Each month there has been made available to the section officers, a written report covering these above two subjects. Armed with the exact data on who had failed to renew membership and which companies had Society members (and which did not), the officers moved with confidence to personally contact all interested in Quality Control for renewal of or application for membership.

We have had occasion to review the data on renewals of A.S.Q.C. membership. On November 1st, 1954, the Society as a whole appears to have secured 63% of last year's members as renewals this year. Huntsville with 91% renewals, Milwaukee with 85% and Worcester with 82%, lead the other sections on the November 1st date. No Membership Chairman, however, could take pride in this unfinished job. We feel at Milwaukee that

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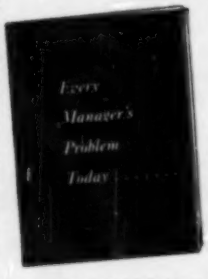

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all officers of the Society have a responsibility to determine and maintain the interest of our members. The non-renewals from Milwaukee on the National Roll have, therefore, been carefully considered and approached. Since we started this activity back in July, we now have a full history on our 33 non-renewals (November 1st, 1954). Four have become paid up members early in November; thirteen now live in areas served by other sections, and are not available for personal contact; the remaining sixteen have various reasons for dropping membership. We realize that a higher renewal rate might be possible, but we feel an excellent job has been done, because we knew exactly what the problem was.

With 74 new members already signed up for this year, we expect that all the care and attention we can now give to the new members and our present renewals will be needed to insure continued interest in the Society. Our practice of formal introduction of new members by a sponsoring member of the Society adds to the enthusiasm within the section, and it is expected to aid in bringing the new member back for next year's activity.

In the analysis of meeting attendance, the cooperation of the officers in recognizing weak points has been outstanding. The written report informs them of exactly the kind of appeal the programs have had. The greatest benefit will be in the ability to be better informed when planning for next year. To date this year, we have had a 30% increase in attendance at the first four meetings over our attendance a year ago.

Knowing exactly where the section stands, allows the Milwaukee officers to develop adequate stimulation of the enthusiasm of our members.

SIGNIFICANT DIFFERENCES

Southern Connecticut Membership Chairman Stuart Lyle is working out a special brochure will will explain Society and section activities to prospective members and how they may benefit by active participation in section work. Guy Boyd of the Raybestos Co. has worked out a clever cover arrangement. A broadened, more representative membership rather than just an increase is the committee objective.

★ ★ ★

Albert Klock, former chairman of the Western Massachusetts Section and a winner of the Brumbaugh Award, is being transferred by the Bigelow-Sanford Carpet Co. from QC superintendent to production as Jacquard Weave Superintendent.

★ ★ ★

W. W. Irvine was recently appointed QC supervisor for the Dunlop Rubber Co. He is working in the tire division.

★ ★ ★

On Dec. 1, 1954 J. Gilbert Mohr joined the Process Development Co. of Genoa, Ohio, in the capacity of general manager. Mr. Mohr was formerly QC manager of the L-O-F Fiberglass Div. plant at Parkersburg, W. Va.

★ ★ ★

Robert C. Bennett of the Delaware Section was recently appointed as manager of Atlas Power Company's new food emulsifier plant at Memphis, Tenn. Mr. Bennett, who was technical superintendent of the Atlas Point, Dela., plant, has been in Memphis since last July assisting in the construction of the new emulsifier plant.

★ ★ ★

Dr. Walter A. Shewhart of the Bell Telephone Laboratories, Murray Hill, N. J., was the 1954 recipient of ASME's Holley Medal. This medal was instituted and endowed in 1924 by George I. Rockwood, a past vice-president of ASME, "to be bestowed for some great and unique act of genius of engineering nature that has accomplished a great and timely public benefit." The honor was bestowed on Dr. Shewhart for his well-known role as the father of statistical quality control.

★ ★ ★

Dr. John Gaillard, a member of the Metropolitan Section of ASQC, was presented the Standards Medal for 1954 of the American Standards Association in recognition of his service in the development of voluntary standards.

American Society News

The Cincinnati Section's Fourth Annual Quality Control Conference was the setting for the midwinter meeting of the Society's Operating and Executive Committees. Preceding the conference by one day, the officers and executive directors of the Society met on Friday, January 28, at the Terrace Plaza Hotel, and on Saturday, January 29, joined the conference at the Engineering Society's Headquarters for continuation of the committee meetings. The officers and directors enjoyed the hospitality of the Cincinnati Section and the more than 300 persons attending the conference.

OPERATING AND EXECUTIVE COMMITTEES

Two full days of deliberations on the operating and administrative problems of the Society kept the committee members extremely busy. They are happy to report that the Nominating Committee has selected the slate of officers for 1955-56, as published in the February issue of IQC.

The Operating and Executive Committees, following earlier consideration of Division structure, activities and growth, reviewed the progress made to date and are glad to report increasing strength in these areas. Furthermore, a number of the Technical Committees are working actively toward Division status. The Electronics Technical Committee has petitioned for Division status and hopes to achieve this before the beginning of the next fiscal year. Further activity in the Automotive group is being encouraged, as well as in the Aircraft, Metals and Administrative Applications Committees.

The Society is currently planning to publish a Yearbook early in the 1955-56 fiscal year. Preliminary

preparations have already been made, and it is now expected that the Milwaukee Section will undertake a considerable portion of the work of actually publishing the book. Each member of Society will shortly be offered an opportunity to verify personal data for inclusion in this publication.

The Executive Secretary reported that the membership of the Society reached 7794 as of January 27, 1955. This represents a significant gain over last year, and is particularly gratifying because of the high percentage of renewals. Diligent work on the part of the several Membership Committees has made this possible, and their continuing efforts to attract new members and encourage renewals will undoubtedly result in a new record for total membership.

Reports indicate that the elections of directors in the sixteen new geographical Districts of the Society are proceeding according to plan. The smooth transition from a directorship representing six Districts to one representing sixteen Districts depends upon prompt nomination and election of Directors prior to April 1. This transition will be further implemented by the action of the present directors whose terms would not normally expire until June 30, 1956; these directors have already submitted their resignations to be effective, June 30, 1955.

The Executive Committee has studied the several proposals submitted for an appropriate memorial to our late president, Raymond S. Saddoris. After careful consideration, this Committee formally renamed the Presidential Award for Section Management, the Raymond S. Saddoris Award for Section Management. The leadership and organization ability of our late President is fittingly honored by the selection of this memorial, the naming of an award which rewards leadership and management in Section affairs.

REPORT OF EXAMINING COMMITTEE

The Examining Committee has just announced the election of the following members of the Society to the grade of FELLOW:

Name	*Section*
Leo A. Aroian	Los Angeles
Carl M. Boswell	Los Angeles
Edward P. Coleman	Los Angeles
James R. Crawford	Los Angeles
Leo J. Jacobson	Philadelphia
J. Y. McClure	Dallas-Ft. Worth

Messrs. Coleman and McClure are currently Directors of the Society. Mr. McClure is also chairman of the Aircraft Technical Committee, and Mr. Jacobson is vice-chairman of the Electronics Technical Committee.

The Officers of the Society wish to congratulate these members for achieving this distinction.

POSITIONS WANTED

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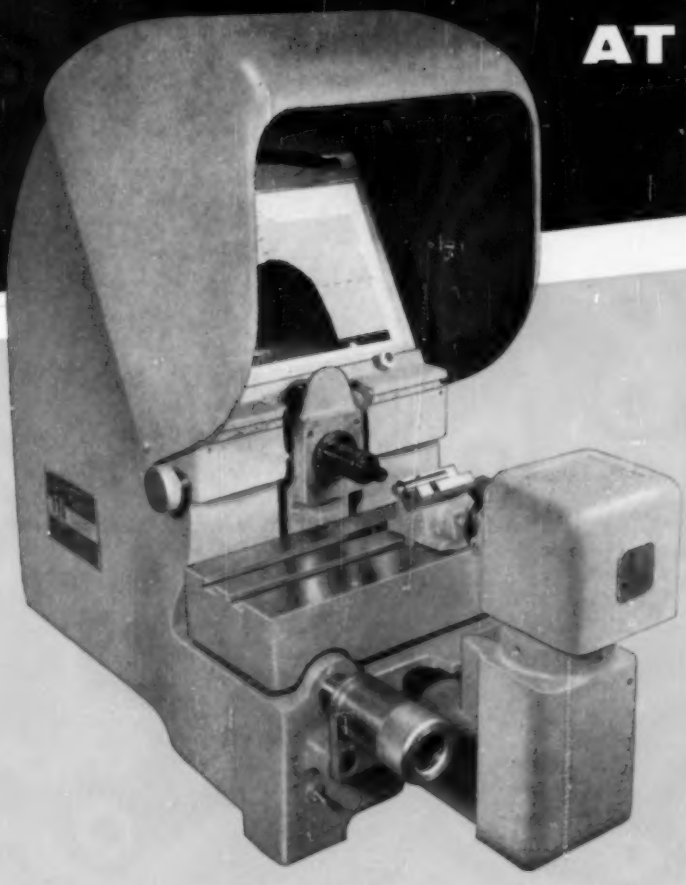

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